

SCIENCE

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THE BERKELEY MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

Edited by Dr. HENRY B. WARD

PERMANENT SECRETARY

THE association has held previously three meetings on the Pacific Coast; the first in San Francisco from August 2 to 7, 1915, was the sixty-seventh meeting of the association. On this occasion Stanford University, the University of California and the Panama-Pacific International Exposition were hosts, and the general meetings were held in San Francisco and on the grounds of the exposition. Many of the societies held meetings on the campus of the university in Berkeley, and the entire program of one day was given on the campus of Stanford University. At

this meeting seven sections and twenty societies took part. This was a noteworthy meeting and drew to it an unexpectedly large number of scientific societies and of leading scientists who participated in their programs.

The second meeting was held at Portland, Oregon, from June 17 to 20, 1925, and was the eighty-first meeting of the association. At this meeting 16 societies took charge of the program, and the sections held no independent meetings. All sessions were held on the campus of Reed College.

The third meeting on the Pacific Coast, the eighty-eighth meeting of the association, was held in Pasadena, California, from June 15 to 20, 1931, and the meeting was characterized by a large attendance and by important scientific programs. The general sessions were held in the Greek Theater, Los Angeles, and other meetings in the California Institute of Technology.

The Berkeley meeting, which extended from June 18 to 23, 1934, was the ninety-fourth meeting of the association. There were 15 sections and 37 societies presenting programs on this occasion.

To the University of California the association was indebted for the extensive facilities which had been placed freely at its disposal; most of the meetings were held on the campus, and the attractive surroundings gave an exceptionally fine environment for the work of the various sections and affiliated societies meeting in Berkeley.

The attendance at the various sessions in Berkeley exceeded expectations. Naturally, the largest number came from Berkeley and the Pacific Coast and mountain states, but other regions were well represented and even from outside the United States a gratifying number of persons was registered. The grand total of registration was 1,164. A considerable number of persons through one cause or another was not formally entered at the registration bureau. The reports from sections and societies indicated that the total number of persons in attendance on the sessions was from 1,600 to 1,800. The attendance at individual sessions and societies so far exceeded the original estimates that it was necessary to find new rooms in order to accommodate some of the groups which assembled. Details of registration are given in the table below.

Stanford University contributed to the meeting im-

ment of the institution. On Thursday the Engineering Section went *en masse* to the Stanford Campus, where both the sections on hydraulics and aeronautics held sessions in the morning and in the afternoon made a tour of the university and the Sunnyvale Air Base, and were given an autogyro demonstration at the Palo Alto Airport. On Friday afternoon members of other sections visited the university and inspected the laboratories, the Hoover Memorial War Library and other points of interest. They were given a concert of Beethoven quartettes most artistically rendered by the Pro Arte String Quartette in the famous Memorial Church.

An item worthy of special mention was the presentation of the Daniel Guggenheim Medal for Achievement in Aeronautics. This was bestowed on William Edward Boeing of Seattle at a formal dinner of the Engineers' Club in San Francisco on Wednesday evening, June 20.

THE PACIFIC DIVISION

All the meetings on the west coast have been general meetings held in conjunction with the Pacific Division and have served to make the association acquainted with the strength of this part of its organization. The Pacific Division of the association had been most active in arranging for attendance, and in providing the program for the Berkeley meeting. Frequent opportunity was afforded for joint discussion and action. The Pacific Division was by invitation represented at sessions of the council and of the national executive committee. Members of the latter body were present as guests at the luncheon meetings of the executive committee of the Pacific Division on Monday, Tuesday and Wednesday. Plans were made for more frequent and intimate contacts.

REGISTRATION AT THE BERKELEY MEETING

East of the Mississippi		Center and South		Pacific Coast and Mountains		Outside of the United States	
District of Columbia	12	Colorado	7	California	557	Canada	6
New York	11	Texas	7	Berkeley	335	Hawaii	4
Massachusetts	10	Minnesota	4	Washington	41	China	4
Ohio	7	Kansas	3	Oregon	39	England	3
Pennsylvania	5	Missouri	2	Utah	27	Japan	2
Maryland	3	Wisconsin	2	Arizona	18	Africa	1
Illinois	2	Alabama	1	Nevada	16	France	1
Indiana	2	Florida	1	Montana	9	Belgium	1
Connecticut	1	Iowa	1	Idaho	7	Sweden	1
Michigan	1	Nebraska	1	New Mexico	5	Holland	1
Vermont	1	Oklahoma	1				
		Virginia	1				
Totals	55		31		1,054		24
				Grand total: 1,164			

portant features that were highly appreciated by the considerable number participating in them. The university distributed a booklet containing views of the campus and outlining the history and develop-

The division agreed to join with the association in the prospective summer meeting in Denver in 1937 in furtherance of a plan to hold joint meetings with the association once every three years, if practicable.

At the business meeting of the Pacific Division, Dr. Bailey Willis, since 1922 emeritus professor of geology in Stanford University, was elected president, succeeding Dr. Joel H. Hildebrand, professor of chemistry in the University of California. Dr. Wm. V. Houston, professor of physics in the California Institute of Technology, was elected to the executive committee, succeeding Dr. S. J. Barnett, professor of physics in the University of California at Los Angeles.

GENERAL SESSIONS

In the enforced absence of the president of the association, Dr. Edward L. Thorndike, the committee was fortunate in securing Dr. W. W. Campbell, president of the National Academy and past president of both the American Association and the Pacific Division, as well as president emeritus of the University of California, to preside on Monday and Tuesday evenings. On Wednesday evening Dr. C. A. Kofoid, representing the University of California, was the presiding officer. On Thursday evening Dr. R. A. Millikan, president of the California Institute of Technology, and on Friday evening Dr. Ray Lyman Wilbur, president of Stanford University, graced the occasions by serving as presiding officers.

Monday evening was devoted to the retiring address of the president of the Pacific Division of the association, Dr. Joel H. Hildebrand, who spoke on "The Liquid State" and illustrated the results of recent research on the intimate relations in the structure and properties of fluids by a series of slides and demonstrations projected upon the screen.

Tuesday evening was devoted to the Maiben lecture. Heretofore these lectures, established two years ago under the terms of the bequest made by the late Hector E. Maiben, have been given only at the annual meeting in the winter. In consideration of the great interest in the Berkeley meeting, including jointly the Pacific Division and the general association, the executive committee secured as Maiben lecturer Dr. L. Dudley Stamp, geographer and economist on the faculty of the University of London and chairman of the British Commission on Land Utilization. Dr. Stamp spoke on "Planning the Land for the Future," and also participated later in the symposium and discussions on land utilization.

The address on Wednesday evening was given by Dr. John C. Merriam, of the Carnegie Institution of Washington, who took as his topic the "Responsibility of Science with Relation to Governmental Problems."

The Thursday evening session was addressed by Dr. Edwin B. Wilson, Harvard University, on the topic "Are There Periods in American Business Activity?" The speaker for the Friday evening general session was Dr. Karl T. Compton, president of the Massa-

chusetts Institute of Technology. His subject was "Science and Prosperity." All the sessions were attended by large audiences and the addresses aroused interest and active discussion subsequently.

BUSINESS SESSIONS

The council of the association held two sessions at Berkeley at which were considered items of immediate importance for the conduct of the meeting, and also certain general business matters looking toward the future. The following deserve mention here:

A report by the permanent secretary on meeting places was presented and after discussion the following assignments for meetings were approved; included therein were those which had already been published. The list is as follows:

Pittsburgh—Winter of 1934, Thursday, December 27 to Wednesday, January 2.

Minneapolis—Summer of 1935.

St. Louis—Winter of 1935, Friday, December 27 to Thursday, January 2.

Rochester—Summer of 1936.

Washington, D. C.—Winter of 1936, Monday, December 28 to Saturday, January 2.

Denver—Summer of 1937.

Indianapolis—Winter of 1937, Monday, December 27, to Saturday, January 1.

The council approved the general plan of arranging for joint meetings of the Pacific Division at intervals of approximately three years.

After discussion with the executive committee of the Pacific Division, it was arranged that the summer meeting of 1937 at Denver should be a joint meeting of the Pacific Division, and the Southwestern Division has also been invited to cooperate on that occasion.

An application for affiliation from the Mycological Society of America was presented and after discussion approved. The society has a total enrolment of 314 members, of which number 171 are fellows and 14 members of the association or a total dual membership of 185 members. The Mycological Society is accordingly entitled to two representatives in the association's council, who will be *ex-officio* members of the Section Committee of the Section on Botanical Sciences.

Amendments to the constitution of the association proposed at the April meeting of the executive committee were laid before the council for the especial information of the western members and the occasion for a change fully discussed. It was the opinion that the preferable form of the amendment was as follows:

Article 2—Membership—of the Constitution of the Association is hereby amended by omitting the clause,

"the annual dues are \$5," and substituting therefor the clause, "the Council shall fix the annual dues."

The entire matter was then referred for the consideration of the council at the annual meeting at Pittsburgh.

Letters from foreign scientific societies nominating representatives for the Berkeley meeting were presented, including the following nominations:

Royal Society of London:

Professor J. W. McBain, F.R.S., Stanford University.
Academy of Sciences of France, Paris:

Dr. W. W. Campbell, president emeritus of the University of California.

Bohemian Royal Society of Science, Praha:

Dr. Henry B. Ward, professor emeritus of zoology, University of Illinois.

Royal Society of South Africa, Rondebosch, Cape Town:

Dr. B. F. J. Schonland, University of Cape Town.

Other organizations which had replied to the request submitted but expressed their appreciation of the invitation without being able to arrange for delegates for the Berkeley meeting were the following: Royal Society of Canada, Ottawa; Academy of Sciences in Vienna; Society of German Naturalists and Physicians, Leipzig.

The phraseology of the plan originally adopted for the Maiben lectures was discussed and approved as recast in the following form:

A lecture shall be given each year to be known as the Hector Maiben lecture to be provided for from the income of the Hector Maiben Fund and to be arranged by the Executive Committee.

The Indiana Academy of Science announced that the semi-centennial of that organization would be celebrated from November 15 to 17, 1934. The academy invited participation from the American Association and steps were taken to arrange for such participation.

The following expression of appreciation of the services of Dr. William Morris Davis (deceased) was presented and ordered spread upon the minutes of the council:

A TRIBUTE TO WILLIAM MORRIS DAVIS

By John P. Buwalda

It is appropriate that the American Association for the Advancement of Science should express and record in its minutes the deep sense of loss suffered by the association and by both scientific men and the public, not merely of this country, but of the entire world, when Professor William Morris Davis died on February 5 of this year at Pasadena, California. A former vice-president (1903) of the association, he also held many important offices in other scientific societies, among them the presidency

of the Geological Society of America (1911) and of the Association of American Geographers (1905, 1909).

Professor Davis was one of the best-known scientific men of this country. Trained as a geologist, with leanings toward geography, his great contributions lie mainly in the field of physiography or geomorphology. In this field he was the acknowledged leader for nearly a half century; his scientific work extended over a period of about six and a half decades. Deep interest, vigor in constructive work and boundless zest marked his life even in his last or eighty-fourth year. His former students all regarded him as a great teacher who, while exacting in his demands, was eminently fair and always desirous of furthering their intellectual welfare. Thousands enjoyed his public lectures and profited from them, for he was a master of popular exposition.

Beginning his teaching career at Harvard in 1877, he continued until retirement in 1912; then followed some years of intensive research, and from 1924 until his death he lectured at universities in Oregon, California and Arizona, continuing actively meanwhile his physiographic investigations.

In response to an invitation from the association, Professor Davis went to Boston last December to deliver the Hector Maiben lecture. His address, later published in the *Scientific Monthly*, attracted wide-spread attention for its scholarly and idealistic character. This occasion was his last public service. Coming as it did in the period of extraordinary severe weather, the trip was undoubtedly a strain, but the service was gladly rendered as a contribution to science and humanity, to which he was ever sincerely devoted.

His scientific contributions were large in number, important in wealth of new ideas, and marked by clarity in writing and forcefulness and thoroughness throughout. As indicated by his numerous popular articles and public lectures he was constantly conscious of the obligation of scientific men to make their knowledge useful. His deep desire, as indicated often in his writings, that the scientific method be applied to the solution of social questions was another expression of the ethical side of his nature. May American science produce many more men of his stamp.

Before adjournment, members of the council expressed their appreciation of the arrangements that had been made and the conspicuous success of the meeting. The following resolutions were adopted and ordered spread upon the minutes as well as transmitted to the persons and organizations concerned:

GENERAL RESOLUTIONS

The council of the American Association for the Advancement of Science, before closing its final session at the Berkeley meeting, wishes to express its deep appreciation of the many courtesies extended to it and of the general cooperation of the University of California in placing at its disposal the facilities of the institution. The abundant resources of the university so attractively located and admirably adapted to the holding of a scien-

tific meeting have served to make the occasion a memorable one in the history of the organization and the council feels its deep indebtedness to President Robert Gordon Sproul and to the Regents and members of the faculty and scientific staffs for the numerous evidences of hospitality and thoughtfulness that contributed throughout the sessions to the comfort and convenience of the membership of the association and its affiliated organizations.

The association is indebted in significant fashion to the officers and members of the Pacific Division for their interest and activity which served to enrich the program and provide high standards for the scientific work of the session. To them are unquestionably due the large attendance and enthusiasm manifested in the sessions which have served so well to carry out the fundamental purpose of the organization.

The local committee under the leadership of Dr. Roy E. Clausen, chairman, and Dr. A. R. Davis, secretary, worked assiduously and thoughtfully to provide for the needs of the association and the other organizations meeting with it on this occasion. The council desires to express its thanks to the officers and members of this committee for the care with which all arrangements were perfected so that the program was carried out with unusual ease and effectiveness in the numerous sections and separate societies.

For the extensive cooperation offered by the communities of the Bay Region and particularly by Alameda County and the City of Berkeley, both of which generously participated in providing the financial assistance necessary to meet the expenses of the meeting, the association desires to recognize specifically its indebtedness and to register its appreciation.

To the numerous cooperating institutions, Stanford University, Mills College, Lick Observatory, the California Academy of Sciences, the San Francisco Chamber of Commerce, the Berkeley Chamber of Commerce, and many other institutions and organizations which have joined to make the meeting an occasion long to be remembered by the participants, the association tenders its grateful thanks.

To the press the association is grateful for the effective handling of scientific work announced at the sessions and for bringing these results to the attention of the public over a region larger than otherwise could have been reached.

SCIENTIFIC EXHIBITS AND DEMONSTRATIONS

In connection with the scientific meeting, various departments of the University of California held open house with exhibits and demonstrations that proved of marked interest to the individual sections and societies. All these items were well explained in the general program of the meeting and members of the association not privileged to attend the sessions at Berkeley may secure copies of the program by sending a request to the office of the permanent secretary in Washington, D. C.

Particular mention should be made of the Special

Exhibit of Old Books. A series of more than 300 books and other publications considered to have been epochal in the history of science were arranged through the efforts of the University Library, the History of Science Society, the History of Science Club and the members of Section L of the association. Of these only 112 books were displayed in glass cases in a special room set aside for the purpose by the library. A brochure descriptive of the collection was prepared by Professors Herbert McLean Evans and James Westfall Thompson. The exhibit included portions of the Hearst Medical Papyrus, which was the special subject of symposium at the joint session of Sections L and N. Included were also a number of portraits of scientific worthies, chiefly in the form of engravings, from the private collection of Professor Evans. The books were taken from the University Library and from the private collections of Professors Evans, Kofoed and Thompson. About 1,200 visitors inspected this exhibit.

Through the cooperation of Mr. Ansel F. Hall, of the National Parks Service, an extensive exhibit of relief models to scale was installed in the foyer of the Hearst Memorial Mining Building. This included especially models of Sequoia, Crater Lake, Mesa Verda, Rocky Mountain, Grand Teton, Zion and Acadia National Parks.

ENTERTAINMENT AND SOCIAL FEATURES

The president of the University of California, Dr. Robert Gordon Sproul, tendered a general reception to the officers and members of the association and distinguished guests. This was given in the Hearst Gymnasium for Women immediately after the opening general session on Monday evening. In the receiving line were Dr. and Mrs. W. W. Campbell, Dr. C. B. Lipman, Dr. and Mrs. J. H. Hildebrand, Dr. and Mrs. A. O. Leuschner and Dr. and Mrs. R. E. Clausen.

All members and visitors were recipients of special attention on other occasions also. Tea was served by the Women's Faculty Club on Tuesday afternoon. On Wednesday afternoon at the International House the distinguished Japanese artist, Chiura Obata, lecturer in art in the University of California, held an informal exhibition of Japanese paintings, and Mrs. Obata gave a demonstration of Japanese flower arrangements. Some Japanese ladies in native costumes served tea, and others entertained with Japanese music and dancing. On Thursday and Friday afternoons individual teas were given in a number of private homes by various members of the faculty.

The trustees and officers of Mills College provided a trip to visit that institution on Friday with luncheon at noon and later a drive through the attractive residential area in Berkeley and Oakland.

Visiting ladies were conducted on a tour of private gardens in the Bay Region on Thursday morning and were welcomed at an open house at the College Women's Club that afternoon. During an all-day tour of Chinatown, conducted on Friday by Mrs. R. E. Clausen, various points of interest were visited under the direction of Chinese guides and with special privileges to see schools, temples and art treasures. Various other clubs extended courtesies to the visiting ladies, as did also the men's clubs to the men in attendance at the meeting. All these events were largely attended and thoroughly enjoyed.

EXCURSIONS

The trip to Mount Hamilton and Lick Observatory on Friday afternoon and evening, made mostly in private cars by many members, furnished an opportunity duly appreciated to see the buildings and equipment and in the evening to get a glimpse of selected objects through the great telescope.

On Saturday one group spent the entire day at the Branch of the College of Agriculture at Davis, California, and were conducted through the experimental laboratories and fields where extensive work on a wide variety of subjects commanded special attention.

Another party visited the various departments of the California Academy of Sciences, where they were received by the administrative and scientific staffs of the academy and enjoyed a demonstration of the extensive natural history collections and of the famous Steinhart Aquarium. A luncheon was served at noon in the Simson African Hall through the courtesy of the trustees and council of the academy. Following this the San Francisco Chamber of Commerce took the visitors on a sight-seeing tour through Golden Gate Park, the Presidio and other points of interest in that city.

Still other members made a speed boat trip around the bay, visiting the new Transbay and Golden Gate bridges under construction, the Mare Island Navy Yard and other points of interest. Individual trips were made at various times to Mt. Tamalpais and Muir Woods, and some were able to extend their trips to the Yosemite and more distant points.

LOCAL COMMITTEE

Thanks to the energy and foresight of the local committee under the leadership of Dr. R. E. Clausen, chairman, and Dr. A. R. Davis, secretary, arrangements had been thoroughly worked out, and the material which was sent in combined in a very attractive program. The extent of this may be well indicated by the fact that no less than 866 papers were listed for the 15 sections meeting at that time and the 37 societies cooperating with the association.

The press service for the meeting, which was cared for by Mr. G. A. Pettitt of the University News Service, was successful in securing much space in paper on the coast and also in the various services reaching other regions.

The details of the work in the various sections and societies are presented by the officers and local representatives in the concluding portion of this report. Evidently a program of the extent indicated could only be imperfectly reported by the brief statements which it is possible to publish in connection with this report. The marked success of the meeting was the subject of outspoken comment on all sides.

SCIENTIFIC SESSIONS

SECTION ON MATHEMATICS (A)

(Report from E. R. Hedrick)

The meeting of Section A was held in conjunction with that of the American Mathematical Society, on Wednesday, June 20. The attendance was gratifyingly large; over one hundred persons, including forty-five members of the society, were present. At the first session, which was held on Wednesday morning, some forty-two short papers were presented either by title or in person. The full account of these is to be published in the July number of the *Bulletin of the American Mathematical Society*.

At the noon recess, a luncheon for mathematicians was served at the Men's Faculty Club.

In the afternoon, Section A and the American Mathematical Society met in joint session with Section K and the Econometric Society. At this session papers were read by invitation only. Abstracts of these papers will be found in the report of Section K.

SECTION ON PHYSICS (B) AND ASSOCIATED SOCIETIES

(Report from L. B. Loeb and Thomas R. Reed)

The 192nd regular meeting of the American Physical Society was held in affiliation with the meetings of Section B from June 19 to June 23. The program consisted of three symposia, the first being a joint symposium on spectroscopy in astrophysics, in conjunction with the Astronomical Society of the Pacific. The second was a symposium on nuclear structure and the third was a symposium on fundamental physical constants. In addition, the regular program of ten-minute papers was held on Friday and Saturday. The meetings were exceptionally well attended, over three hundred auditors being present at the nuclear symposium sessions.

The Physical Society met at luncheon at the Faculty Club on the days on which the meetings were held, with an average attendance of about fifty. The dinner was held on Wednesday evening, at which Pro-

Professor R. W. Wood, vice-president of the American Physical Society, spoke informally on "The Physicist as a Detective."

Both the invited papers on the symposia programs and the ten-minute papers were of an exceptionally high caliber. It is impossible to do more than mention certain of the outstanding papers. The paper on "Diffraction Gratings and their Application to Astronomical Problems," by Professor R. W. Wood, which was accompanied by demonstrations, gave an inspiring picture of the triumph of mechanical technique over almost insurmountable difficulties in the perfection of adequate gratings. Particularly notable was the development of an accurate type of transmission grating, throwing most of the light into the first order, applicable to astronomical observation on large telescopes, which will greatly simplify the studies of star clusters and nebulae. Another feature of the astrophysical session was the summary of the spectroscopic evidence of galactic absorption, by Dr. R. J. Trumpler, of the Lick Observatory, who gave an analysis of the means by which this evidence has accumulated and the conclusions to be drawn therefrom.

The discussions in the nuclear symposium were introduced by an excellent paper by Professor R. J. Van de Graaf, in which he summarized the various methods which had been perfected for the production of high energy particles for nuclear disintegration, and indicated the different ways in which these methods were being applied. Perhaps one of the most notable papers presented gave the results obtained by Dr. M. A. Tuve on the work of his group in the Department of Terrestrial Magnetism of the Carnegie Institution. These investigations were carried on at about one million volts energy and had differed in the results yielded from the investigations carried on at the California Institute and at the University of California. As a result of intensive discussion, Dr. Tuve was able to show that the previous outstanding discrepancies in the findings were almost entirely to be ascribed to the difference in energies of the incident particles utilized in the respective laboratories, together with the measuring techniques used in the identification of the disintegration products. It appears that the results are not contradictory in the least, but rather supplementary, and that the behavior of the nuclei under different modes of excitation and detection is very much more complex than had been previously anticipated, there being marked differences in the nature, energies and yields of the disintegration products, depending on the energy of the incident particles. The papers of Professor Lawrence and Professor Lauritsen further detailed the differences obtained under different conditions and made a consistent picture with the findings of Dr. Tuve.

The essential element of the very important paper

of Professor Carl D. Anderson on disintegrations with positron ejection, most of which were carried out with cosmic ray secondaries, led to the conclusion that many of these phenomena require the creation of large numbers of gamma rays as secondary products, in addition to the very large yield of positive and negative electrons. Another important feature brought out was that the major proportion of high energy incident particles in these cosmic ray phenomena are of masses far smaller than the hydrogen atom, and are probably of the order of the mass which is ascribed to the negative electron. Dr. Thomas Johnson summarized his recent investigations on the nature of the cosmic ray by stating the belief that the large majority of the primary cosmic ray particles have a positive charge and are of prodigious energy.

The symposium on fundamental physical constants included a paper by Dr. Felix Bloch, of Stanford University, who developed the complete equation for the Compton shift, which enables one to bring the values of the fundamental physical constants, determined from the Compton effect, into agreement with the e/m and other measurements. In addition, Dr. C. D. Shane presented a notable contribution to the accurate evaluation of the physical constants, notably e/m , as a result of the very beautiful investigations made by himself and Dr. F. H. Spedding on the fine structure of the $H\alpha$ line. These results were made possible through superb experimental technique, aided by a fine interpretation of the results obtained. In addition, the paper by Professor Millikan on the value of the electronic charge constituted a valuable feature of the program, connecting the present-day knowledge with the earlier historical findings.

The whole problem of the values of the fundamental constants was summarized by Professor R. T. Birge, and served to tie together the very complex mass of data on physical constants in such a fashion that a reasonable interpretation as to the most probable values could be gained. From the data of Professor Birge, it appears that his recently published values of e , h and e/m are the most reliable and that the correct value of e is 4.768×10^{-10} es units, with $h = 6.547 \times 10^{-27}$ erg.sec, and $e/m = 1.7574 \times 10^7$ em units, and $1/\alpha = 137.41$.

Among shorter contributed papers are: One by Robert N. Varney, who described the measurement of the ionizing energies of positive ions in gases obtained by the balanced space charge method, which appears to be the most sensitive method of detection used today; a paper by Dr. Otto Beeck, of the Shell Development Company, who was able, through the use of the method of molecular beams, to show that the dehydrogenation of hydrocarbons in impact with a heated platinum surface proceeded at a critical tem-

perature (in analogy to the ionization potential measurements) and that in this process both the dehydrogenated hydrocarbon and molecular hydrogen rebounded from the hot surface without being adsorbed and without any heat of activation; the paper of Dr. Franz N. D. Kurie on disintegrations by neutrons in air in which the exploding atom was observed in rare instances to emit a proton of exceedingly long range. Finally, a most interesting paper concerning the general interpretation of cosmic ray effects was given by Professor R. A. Millikan, who drew the following conclusions: (1) Practically all cosmic-ray ionization is due to the passage of electrons (+ and -) rather than protons, alpha-rays or heavier nuclei, through the atmosphere. (2) More than 70 per cent. of this ionization, probably 80 or 90 per cent., is due to secondary electron-rays produced within the atmosphere by incoming photons and electrons (+ and -). (3) There is no evidence that anywhere on the earth more than 3 or 4 per cent. of the ionization found at sea level is due directly to incoming electrons; their number is therefore very small. They are responsible, however, for the latitude effect, the longitude effect and the east-west effect. (4) Photons in general interact only with electrons (+ or -), whether in the nucleus or out of it. A photon colliding with a nucleus detaches one or many free electrons (+ and -) from it but not protons. (5) The earth's magnetic field separates the low energy incoming secondary electrons formed outside our atmosphere from the high energy, letting the former in near the poles but only the latter near the equator. These latter are predominantly positive, since they necessarily come from the nuclei of atoms and these have an excess of positive electrons. (6) The greater part of the ionization of our atmosphere is due to photons of energy of the order of 130 (\pm 100) million e.-volts.

The meeting of the American Meteorological Society was given distinction by the attendance of Mr. W. R. Gregg, newly appointed chief of the Weather Bureau. Mr. Gregg, a charter member of the society and its treasurer for many years, opened the sessions with a report of plans for carrying out the recommendations of the President's Science Advisory Board looking to the adoption by our national weather service of Norwegian methods of air mass analysis. This was the first time a western meeting of the society has been dignified by the attendance of a national weather chief, and the significance of his message, marking perhaps a new era in the history of the Weather Bureau, enhanced the uniqueness of the occasion. Due to the unusually crowded program (34 papers having been scheduled) it seemed doubtful that the six half-day sessions would be sufficient to permit all to be heard. A limit of one-half hour to each was therefore prescribed, and the sessions

were brought to an end exactly on time. A wide range of meteorological subjects was covered, those dealing with fire-weather relations predominating—and frost problems suffering total eclipse. This proportionality, although unstudied, was quite appropriate, the West having just passed through a relatively frostless winter, while being faced with a fire situation in the forests which is not without its ominous aspects due to the subnormal precipitation in many areas.

SECTION ON CHEMISTRY (C)

(Report from G. K. Rollefson)

Section C met in conjunction with the Pacific Intersectional Division of the American Chemical Society for a series of six half-day sessions. The opening session on Tuesday morning was devoted to a selected group of papers on physical chemistry. Professor J. W. McBain discussed the methods of measurement and magnitude of surface conductance. Professor Gilbert N. Lewis presented some results dealing with the change of vapor pressure caused by replacing hydrogen by deuterium in certain compounds. He also discussed the effect of such a substitution on the dissociation constants of acetic acid and ammonium hydroxide. The next paper by W. F. Giaque and D. P. MacDougall described the methods which have been employed in the University of California to obtain temperatures below 1° K. In the two succeeding papers Professors Badger and Pauling discussed a number of problems of molecular structure. The session closed with a paper by Professor W. M. Latimer on "Ionic Entropies and Their Uses."

The Wednesday morning session was devoted to a selected group of papers on biochemistry. Professor Roger T. Williams discussed the significance of pantothenic acid, particularly with reference to yeasts. Then Professor K. V. Thimann presented a summary of some recent advances in the study of plant hormones. Professor J. Murray Luck traced the steps followed in some cases of intermediary protein metabolism. Professors D. M. Greenberg and Harold Goss dealt with some phases of the animal biochemistry of calcium, magnesium and phosphorus.

The Tuesday afternoon and Thursday sessions were taken up by contributed papers in physical and inorganic chemistry, with organic and biological chemistry papers on Wednesday afternoon. At the latter session Dr. H. H. Strain presented an interesting experimental demonstration of the separation of carotenes by selective adsorption. One group of papers dealt with the application of quantum theory to organic chemistry both from the standpoint of the structure of molecules and the mechanism of reactions. Another group dealt with electron-diffraction deter-

minations of the structure of molecules. Other groups dealt with thermodynamics, photochemistry, determinations of fluorine and iron in small quantities, radioactivity and miscellaneous papers in organic chemistry. In addition to these scientific activities a chemists' dinner was held on Wednesday evening, and Phi Lambda Upsilon had a luncheon on Tuesday.

SECTION ON ASTRONOMY (D) AND ASSOCIATED SOCIETIES

(Report from C. D. Shane and H. H. Nininger)

Sessions of the Astronomical Society of the Pacific were held at the Students' Observatory on Thursday morning and afternoon and Friday morning. They were well attended, the average number present being about seventy. Forty papers were presented, of which only a few can be discussed here.

The Thursday morning session was devoted to papers on variable and binary stars and the spectrum of stars and nebulae. Dr. W. F. Meyer presented the results of a careful analysis of the radial velocity variation of *Beta Canis Majoris*, in which it was shown that the numerous observations can be explained completely on the basis of two slightly different periods with unequal amplitudes. One of these periods is the same as the period of variation of line width in the star. Dr. W. H. Wright discussed his recent discoveries of new nebular lines in the ultraviolet. These discoveries were made possible largely through the use of aluminum on the Crossley reflector. He reported on a number of identifications of these lines made by Dr. I. S. Bowen and on Bowen's suggestion that certain oxygen and nitrogen lines owe their origin to excitation by the resonance line 303 of ionized helium.

On Thursday afternoon the papers dealt with stellar and solar spectra. Dr. R. F. Sanford presented a paper on the interpretation of the radial velocities of class N stars in terms of galactic rotation. It was shown that the main features of the rotation are reflected in these radial velocities.

Dr. J. H. Moore discussed the appearance of the Fraunhofer lines in the spectra of the corona with reference to their displacement and widening. No theoretical explanation seems to account fully for the observed properties of these lines. It was also pointed out that the wave-length of maximum energy in the coronal spectrum agrees approximately with that of the solar spectrum.

Messrs. Harold D. and Horace W. Babcock presented the results of their studies of the solar spectrum in which a number of new features had been found. Most interesting among these are the observations of coronal lines in the spectrum of the sun's limb.

The Friday morning session contained papers on sun-spots, planets and theoretical astronomy. Dr. E. C. Slipher described the studies of himself and Drs. V. M. Slipher and Arthur Adel on the giant planets. His remarkable photographs of Jupiter and Saturn were shown to illustrate changes in appearance of these planets and in particular the numerous white spots discovered on Saturn. The work of V. M. Slipher and Arthur Adel in identifying the absorption bands in the outer planets with bands of ammonia and methane was described. It was pointed out that only a few weak bands remain unidentified.

On Thursday evening a dinner at the Claremont Country Club was attended by about twenty-five members of the section and their wives. The final feature of the meeting was an excursion to the Lick Observatory on Friday afternoon and evening.

A joint session on the subject of the application of spectroscopy to astronomy was held with the Section on Physics and reported by the latter.

At the Berkeley meeting the science of meteoritics for the first time occupied a special place on the program of the association. Representatives of the newly organized Society for Research on Meteorites presented papers on various phases of this subject before sessions of that society which were held in the Students' Observatory on Monday and Wednesday at both forenoon and afternoon sessions.

Dr. Frederick C. Leonard, of the University of California at Los Angeles, president of the Society for Research on Meteorites, presented a brief résumé of the society's accomplishments during the first year of its organization. He pointed out several lines of activity along which the society has already succeeded in stimulating action and suggested several other lines of investigation which he hopes to see undertaken in 1934. He also reported a very encouraging growth in the membership of the society from the time of its organization to the present date.

Among the more important papers were the following: Professor H. H. Nininger, of the Colorado Museum of Natural History, presented an illustrated discussion of the "Surface Features on Meteorites." This paper included a résumé of accepted beliefs concerning the aerial shaping of meteorites and the presentation of numerous facts pointing to a much more rapid surfacial erosion than has been assumed by older writers.

The writer believes he has ample evidence to prove that the ordinary meteors of nightly occurrence must be occasioned by much larger bodies than has usually been assumed to account for them.

An outstanding feature of the program was an address by Dr. Robley D. Evans, of the University of California, on "Radioactivity and the Age of Meteor-

ites." This lecture illustrated very graphically how the science of meteoritics may contribute to the solution of geological problems. The radium content of about one hundred specimens of meteoritic material has been determined by various workers. Radium is found in somewhat smaller quantities than in terrestrial rocks; it is least abundant in iron meteorites and most abundant in stony meteorites. Age measurements based on the helium-radium ratio in meteorites were made by Paneth, Urry and Koeck, who found ages between 100 and 2,800 million years for 22 specimens. Since these values are not clearly greater than the ages assigned to terrestrial rocks, it is concluded that the meteorite specimens tested were of the same age as the earth and hence had their origin in the solar system, not outside it.

Apparatus is now being perfected with the aid of which it may be possible to determine the age of meteorite specimens by measuring the ratio of the uranium isotopes in the meteorite. Such a method has the advantage of avoiding errors due to loss of helium gas from the specimen. It is, however, very difficult from the experimental standpoint.

SECTION ON ZOOLOGICAL SCIENCES (F) AND ASSOCIATED SOCIETIES

(Reports from S. F. Light, Arthur Svihla, J. M. Linsdale, Stanley B. Freeborn, H. A. Scullen, C. A. Kofoid and Mrs. Alvin Seale)

The Western Society of Naturalists furnished the only medium for the presentation of zoological papers, as well as those of a wider biological nature. The symposium on "The Protozoan Life Cycle" was especially stimulating and well attended. Professor C. V. Taylor, of Stanford University, discussed protoplasmic reorganization and suggested that the more or less complete redifferentiation following dedifferentiation which occurs at critical periods in the protozoan life cycle is equivalent to the embryonic development of the metazoan, hence its completeness. Dr. A. G. Giese, of Stanford University, discussed the influence of environmental factors on the cycle, particularly on conjugation. Dr. E. H. Myers, of the Scripps Institution of Oceanography, presented by means of a moving picture the essential features in the life cycle of the foraminiferan *Patellina corrugata*, the first completely known life cycle of the group, based on cytological evidence. Significant was the absence of a flagellate phase. Dr. C. A. Kofoid, of the University of California, stressed the similarity, in essential features, of the protozoan and metazoan life cycles. He pointed out that in the lower Protozoa the cycle is asexual only, but in the higher Protozoa a sexual phase intervenes with maturation of haploid gametes, the diploid zygote starting the

asexual phase with cleavage but without formation of germ layers or differentiation in structure and division of labor, as in the Metazoa.

Aside from the symposium, some 35 papers were presented in four sessions, one for papers on experimental morphogenesis, one for general papers and two for papers dealing with physiological problems. Joint sessions were held with Section G for the presentation of papers on genetics and for a symposium on "Genes in Relation to Characters."

Some 225 biologists attended the Biologists Dinner at the International House, sponsored by the Western Society of Naturalists, at which Dr. Albert F. Blakeslee, of the Carnegie Institution of Washington, gave a talk and demonstrations on inheritance and variation in taste and smell.

The Committee on Oceanography of the Pacific and the Western Society of Naturalists had a joint luncheon on Tuesday noon, at which reports of the advances made in the field of oceanography were presented, especially from the Scripps Institution of Oceanography at La Jolla and the Department of Oceanography of the University of Washington.

The American Society of Ichthyologists and Herpetologists (Western Division) held its sixth annual meeting on Wednesday, June 20. Dr. F. B. Sumner, of the Scripps Institution of Oceanography, discussed the mechanism of color changes in fishes. Dr. L. M. Klauber, of the San Diego Museum of Natural History, described the formation of the rattle in the rattlesnake and showed a series of lantern slides of the various forms of rattlesnakes of the United States, Mexico and South America. Dr. Vasco M. Tanner, of Brigham Young University, showed the changes which have occurred in the fish fauna of Utah Lake since the advent of the pioneers in that region, due to the utilization of the waters entering the lake for irrigation purposes. The lake itself has changed from a fresh-water lake to a salt-water lake affecting the original fish life. This, together with excessive commercial fishing, has so depleted the fish fauna that during the past eight years only 19 specimens of the salmon trout have been taken, whereas during pioneer days it occurred in myriads. Other papers covered a wide range of topics, but particular emphasis was given to life histories, adaptation, disease and general problems of taxonomy. A number of live western reptiles was exhibited by Sherwin F. Wood, of the University of California.

The following officers were elected for the coming year: *President*, Dr. L. M. Klauber, San Diego Museum of Natural History; *Vice-president*, Dr. L. P. Schultz, University of Washington; *Secretary-Treasurer*, Dr. Arthur Svihla, State College of Washington.

The Entomological Society of America held its

meeting on Friday morning, June 22, in conjunction with the Lorquin Entomological Club, the Pacific Coast Entomological Society and the Pacific Coast Branch of the American Association of Economic Entomologists.

A variety of interesting papers was presented which dealt with insectan life histories, structure and ecology. Considerable interest was created by a critique of the prevailing theories concerning the multiple generations of leafhoppers which was presented by Dr. E. D. Ball, of the University of Arizona, in a paper entitled "The Number of Generations in a Season in the Leafhoppers."

On Saturday morning, June 23, the members enjoyed an open house program at the Entomological Section of the California Academy of Sciences in San Francisco.

The American Association of Economic Entomologists (Pacific Coast Branch) discussed citrus insects, insects of dried fruit and mosquito control and many other subjects of special interest to California. Over fifty papers were presented by members from most of the western states and the Hawaiian Islands. The attendance was well over one hundred.

Some of the other subjects which proved of interest to those in attendance were codling moth control, several papers relating to beekeeping, the beet leafhopper, which transmits the serious curly-top disease of sugar beets, various problems relating to spraying, dusting and other forms of insect control. A joint meeting was held with the California State Veterinary Medical Association, at which time a number of papers of interest to both groups was presented. The sessions closed on Thursday evening with an informal dinner.

The following officers were elected for the ensuing year: *Chairman*, H. E. Burke, Palo Alto, California; *Vice-chairman*, William Moore, Azusa, California; *Secretary-Treasurer*, H. A. Seullen, Corvallis, Oregon.

The American Society of Parasitologists held two sessions, the first in conjunction with the Western Society of Naturalists and Section F, and the second in conjunction with Section N. A total of fourteen papers was presented in the fields of trypanosomiasis of the wood rat, the hydrogen-ion concentration of the mammalian intestine with reference to the incidence of protozoans, the leucocytic formula of the gecko with haematozoan infections, the distribution of helminth parasites in California amphibia, the relation of diet to amoebic infections in man, the pathogenicity of *Trichomonas vaginalis* and experimental infections therewith, the eye worm of the dog in a human case, the tick and mammalian sources of relapsing fever in man in the Sierra Nevada Mountains, and the incidence of human intestinal Protozoa

in five thousand persons from one to twenty-one years of age.

The San Francisco Aquarium Society held morning and afternoon sessions on Tuesday, June 19, for the presentation of papers. A dinner held at the Women's City Club on the same evening was well attended. The society's exhibit of tropical fishes and methods for their culture aroused much interest.

SECTION ON BOTANICAL SCIENCES (G) AND ASSOCIATED SOCIETIES

(Report from Richard M. Holman)

The program of the Botanical Society of America consisted of three half-day meetings, with two sessions, a general and a plant physiological session, going on simultaneously. Eighteen papers on anatomical, mycological, taxonomic, cytogenetic and morphological subjects were presented. The plant physiological sessions included thirty-five papers contributed by members of the Botanical Society, of the American Society of Plant Physiologists and others introduced by members of these societies.

Under the auspices of the section there were held on Thursday morning two symposia, one on "The Origin and Development of North Pacific Floras" and one on "The Absorption and Accumulation of Mineral Elements by Plant Cells." The former included eight invitational papers. The symposium on absorption and accumulation of mineral elements consisted of a series of five invitational papers.

On Thursday afternoon, on invitation of Section G, Dr. Göte Turesson, of the Botanical Institute of the University of Lund, Sweden, presented an illustrated address entitled "Ecotypic Constitution and Geographic Distribution," and Professor H. C. Thompson, of Cornell University, gave an address, also illustrated, on the "Relation of Temperatures and Length of Day to Reproduction in Certain Plants."

At the business meeting of the Pacific Section of the Botanical Society of America, on Wednesday afternoon, by-laws presented first at the Salt Lake meeting were discussed and adopted. Dr. O. L. Sponsler was elected president and Dr. Flora Murray Scott secretary-treasurer for the year 1934-35.

At the meeting of the American Phytopathological Society, Pacific Division, forty-two papers were presented, abstracts of which will be published in *Phytopathology*. As indicated by the papers, research this past year has been confined largely to diseases of fungus and virus origin as well as to mycological studies. Thirteen papers dealt with fungus diseases, and ten were concerned with viruses. Nine papers were essentially mycological in scope. The remaining

reports were concerned with bacterial diseases, disinfectants and nematode control.

At a business meeting the following officers were elected: *President*, C. O. Smith, Citrus Experiment Station, Riverside, California; *Vice-president*, C. W. Bennett, U.S.D.A., Riverside, California; *Secretary-Treasurer*, B. A. Rudolph, University of California Deciduous Fruit Station, San Jose, California; *Councilor*, T. E. Rawlins, University of California, Berkeley.

The meetings were exceptionally well attended; seventy-one signed the register. An elaborate Italian dinner at a café in Oakland at the close of the meetings was enjoyed by virtually all members.

SECTIONS ON ZOOLOGICAL SCIENCES (F) AND
BOTANICAL SCIENCES (G)

(Reports from E. B. Babcock and A. W. Sampson)

The Genetics Society of America held its first summer meeting on June 20, convening jointly with the Western Society of Naturalists and the Botanical Society of America. Abstracts of the papers presented in these two half-day sessions will be published in the proceedings of the society. Three of the nine papers presented were mainly cytological. These dealt with heteromorphic chromosomes in the tomato, the nature of chromosome association in tobacco and the nature of chiasmata localization in two species of onion, a hybrid between them, and backcross progeny. In the last paper the first evidence ever to be reported was presented, indicating the existence of a genic difference between the two species controlling chiasmata localization. Two papers treated of rodents; one of these reported a recent mutation in the rat called curly; the other considered coat color inheritance in *Peromyscus* in relation to subspecific relations. Other papers dealt with crossing-over in the X-chromosomes of attached X triploid females in *Drosophila*; the relation of adult body size to rate of cell division in the chicken embryo; the turkey as an experimental animal; and the occurrence of new genes in *Datura* plants grown from aged seeds. A symposium on "Genes in Relation to Characters" included four papers in which evidence was presented from *Drosophila*, rabbits, *Datura* and chickens. Although few generalizations are possible as yet, it is certain that promising beginnings have been made and lines of future research suggested in this important field. On June 21 the society met jointly with the Western Branch of the American Society of Agronomists, by which the papers there presented are reported. On June 21 about 30 geneticists, many of whom are members of the society, met informally at luncheon.

The Ecological Society of America presented a program in two sessions: the first consisted essentially of

subjects in forest ecology; the second was more varied. The program was started with a review by A. E. Wieslander of the progress of the cover type mapping in California. The primary object is to provide basic data for the use of foresters and engineers in perfecting a state-wide land-planning program. This paper was followed by a review of a root system study of *Sequoia sempervirens* by Professor E. Fritz. The findings are revolutionary with respect to the reaction of roots of these "mammoths of the woods" to soil filling. A tree 1,200 years old, which survived seven flood deposits of a total depth of 11 feet, developed seven new systems of laterals. Not less interesting was the report by C. J. Kraebel of the "snail's rate" of revegetation of a 200,000 acre area in northern California denuded of higher plants by smelter fumes. The great systems of gullies formed in the absence of vegetation are still enlarging. Planting of native willows is correcting the erosion evil. Rodents, as pointed out by E. E. Horn, greatly curtail invasions of conifers in parts of the California pine belt. Since the seedlings of some tree species are ravenously eaten by rodents, only those of low palatability are regenerating. The rodent population must therefore be controlled. This suppression of certain plant species should find application of the new technique for deriving plant frequency indices, as reported by Dr. W. G. McGinnies. The Raunkiaer law of frequency appears to be generally useful in determining stages of succession. The first session was concluded with a review of water consumption by riparian vegetation in a typical canyon bottom in southern California. Such cover, because of its long growing season, uses much water compared with that of the dry adjacent slopes.

The second session was started with a review by Dr. Edith A. Purer of a study of ecological requirements of plants on Silver Strand of southern California. The greater radiation and evaporation of the dunes proper, compared with the lee of the dunes, evidently accounts for the presence of distinct plant forms. Illuminating color slides were shown. Variation in growth habit and in anatomical structure of the highly plastic *Atriplex semibaccata* was interestingly shown by Dolores M. Bullock. Size and thickness of leaves is largely determined by edaphic factors. Typical communities of widely divergent habitats were pictured by Dr. Forrest Shreve in presenting his progress report on the vegetation of the Sonoran Desert. The fact that dunes near the Salton Sea may shift 50 feet or more in a month, as painstakingly measured by M. J. Rampel, clearly accounts for the ever-changing vegetation of such areas. A second paper, by Mr. Rampel on the phytogeographic features of the Colorado Desert, reported heretofore unknown

vertical ranges of several species of divergent growth requirements. The final discussion was left to Dr. A. M. Johnson whose studies revealed conspicuous differences in length of growing season of chaparral species in the Santa Monica Mountains of southern California.

On the day preceding the meetings, visiting ecologists inspected various laboratories and special physical instruments used in ecological studies on the University of California campus. Of greatest interest, perhaps, was the trip to Strawberry Canyon, where several erosion plots, automatically operated, were functioning.

SECTION ON ANTHROPOLOGY (H) AND ASSOCIATED SOCIETIES

(Report from W. M. Krogman and R. L. Beals)

Section H met jointly with the Pacific Division of the American Anthropological Association. The meetings were in general devoted to archeological and ethnological problems of the Southwest and the Pacific Coast. The Wednesday morning session dealt with problems of chronology and contact in time. Dr. E. B. Renaud reported that prehistoric arrowhead types in Colorado and Nebraska revealed significant differences in succeeding periods and in contiguous areas. Dr. W. S. Stallings, Jr., and Dr. A. B. Reagan reported on pueblo sites examined by them. Mr. F. S. Setzler outlined investigations of the prehistoric "Cave Culture" of southwestern Texas. Dr. Byron Cummings outlined prehistoric textile-types from the caves of Arizona. Dr. Donald Brand offered a very thorough analysis of pottery-type distribution in Northwest Mexico (Sonora and Chihuahua). Dr. Florence Hawley presented a very interesting account of the application of the tree-ring method of chronology. A process of dating the refuse heaps with great accuracy by means of charcoal fragments was described. Dr. Arthur Woodward discussed cremation burials of the Hohokam and stated that three types of cremation were sequential and hence of aid in chronology. Dr. R. L. Beals then summarized the important problems inherent in possible cultural contacts between the Southwest and Mexico.

The Thursday morning session focussed upon ethnological problems with special reference to the elucidation of historical cultural elements. Dr. V. F. Ray traced the history of the Kolaskin cult, a Messianic movement which arose in 1870 in northwestern Washington. Dr. Cora A. DuBois then reported on the 1870 Ghost Dance and subsequent religious movements in northern California. Dr. Erna Gunther reviewed the spread of Messianic cults, noting especially the Indian Shaker religion of Washington, in

1882. Dr. Stanislaw Klimek offered a preliminary account of the relationship between groupings of California tribes made on the basis of economic traits and kinship series. Dr. Isabel T. Kelly presented the results of her study of Southern Paiute bands; fifteen distinct tribal units were recognized. Dr. Peveril Meigs, III, reported on his study of the aboriginal population density of Lower California. Dr. J. W. Hoover then gave a very instructive paper on the development and sites of Papago villages in Arizona and Sonora. Dr. E. W. Gifford discussed the cultural position of the Yavapai, pointing out the diverse cultural contacts of the several divisions of this group. Dr. L. S. Cressman spoke on the pictographs and petroglyphs of Oregon. Dr. Melville Jacobs then reported the preliminary results of his study of Coos ethnology. Miss Edna Fisher presented a report on 88 shell mounds of the Monterey Peninsula.

The Thursday afternoon session was devoted to physical anthropology. Dr. D. Rubin de la Borbolla discussed tooth mutilation in ancient Mexico. Dr. W. M. Krogman then outlined methods of skeletal study. Dr. W. W. Greulich presented a paper on the heredity of human twinning, based on family histories of 988 parents of twins. Dr. E. W. Count, in a preliminary report, offered the suggestion that the angle formed by the intersection of the coronal and sagittal sutures in primates might have taxonomic significance. Dr. Horace Gray presented a discussion of the body-build in convicts, based on a study of 587 male white convicts, aged from 20 to 80 years, at Joliet, Illinois. Dr. F. S. Hulse offered a preliminary report of his study of Japanese children born in Japan, in Hawaii and in California.

The Friday morning session centered upon the discussion of specific ethnological features and upon theory and method in anthropology. Dr. A. O. Bowden discussed the rôle of prestige among primitive peoples as a powerful force for social contact. Dr. W. H. Davis gave a very interesting analysis of figures of speech in every-day English as an index to social memory. Dr. J. H. Steward presented data from a number of primitive tribes to demonstrate that the patrilineate has an ecological basis. Dr. C. W. Bishop then offered material to elucidate his thesis that China has always been an integral but archaic and slightly aberrant subdivision of the ancient world of culture. Dr. F. Clements presented a preliminary report on the mound cultures of eastern Oklahoma. Dr. Florence Hawley outlined very briefly the proposed adaptation of oak and cedar tree-ring dating of prehistoric mounds in the Mississippi Valley. Mr. Willard Z. Park concluded the session with a discussion of the masked clown dance in the Great Basin as an example of diffusion of a cultural trait-complex.

SECTION ON PSYCHOLOGY (I) AND ASSOCIATED
SOCIETIES

(Report from Warner Brown and John A. McGeoch)

The joint sessions of Section I and the Western Psychological Association were held from Thursday to Saturday. On Thursday morning these two organizations joined with Section Q in a symposium on "Guidance." Professor Truman L. Kelley outlined a method for applying scientific analysis to the problems of guidance; Professor E. K. Strong dealt with interest, particularly as measured by the Strong Interest Test, as a factor in guidance; and C. G. Wrenn reported on a personnel program at Stanford with students of high intelligence. The same three organizations joined on Thursday afternoon in a symposium on the topic "Can Personality Be Measured?" The contributions were primarily concerned (1) with the problem of systematic definition of personality and (2) with the value of some of the recent attempts, such as the Bernreuter test, to measure personality.

The Friday morning session was devoted to reports of experimental studies of personality and to social psychology. On Friday afternoon there were two parallel sessions, one upon experimental problems in learning and perception and the other mainly upon testing and child psychology. The joint dinner of Section I and the Western Psychological Association was held on Friday evening at the International House. Professor Edwin R. Guthrie, president of the Western Psychological Association, gave an address, entitled "Skill and Associative Learning," in which he surveyed critically some of the current conceptions of learning and reinterpreted the systematic relations of skill, habit and association.

Parallel sessions were held, also, on Saturday morning, one mainly upon child psychology and one upon comparative and physiological psychology. The Saturday afternoon program dealt with a variety of experimental problems not readily classifiable under a single rubric. The program closed with the showing of motion pictures of infant tests made at the University of California Institute of Child Welfare. Abstracts of the papers read at the joint sessions of Section I and the Western Psychological Association are to be published in the *Psychological Bulletin* within a few months.

SECTION ON SOCIAL AND ECONOMIC SCIENCES (K) AND
ASSOCIATED SOCIETIES

(Report from John B. Canning)

Recent developments in monetary theory and in national monetary policies were the general subject of discussion at the Wednesday morning meeting. Professor T. J. Kreps, reporting progress on a statistical study, presented evidence that the received

equations of exchange hold only for limited portions of the range between extreme deflation and extreme inflation. He suggested that further study may disclose critical points in bank credit supply, in currency supply, and in rate of currency turnover at which monetary behavior undergoes phase changes corresponding roughly to those found in chemical behavior at the points of change from solid to liquid and from liquid to gaseous states in chemistry.

Dr. Carl A. Landauer explained the mechanism of financing Germany's recent public works programs. He suggested that the appearance of comparative stability in German exchange rates and price levels may turn out to be illusory. The investment of banking reserves in public works bills and in the special issues of treasury public works notes (which thus far have served the ordinary purposes of money) may, he thinks, result disastrously unless Germany's transfer problems can be better adjusted to the internal financial policy.

Dr. Frank A. Waring discussed the need for unified reserve requirements, based partly on deposits and partly on mean daily debits to deposit accounts, if bank reserves are to be employed as a device for credit control and for price stabilization. He suggested several minor changes in the recommendations made on this subject by the committee on bank reserves of the Federal Reserve System.

The Wednesday afternoon program was devoted to the problems of consumer protection in a planned economy. Professor E. T. Grether reported several tendencies observed under legalized price maintenance in Great Britain and California (1) the growth of hidden price-cutting expedients; (2) the merchandising stress upon dealer "services"; (3) the increase in numbers of dealers; and (4) the widening of spreads between manufacturers' prices and prices to customers at retail.

Mrs. M. G. Luck discussed the problem of regulating industry in the interests of the consumer. She disclosed some of the tremendous technical and administrative problems of precise labeling for consumer goods and of formulating standards of quality in the case of those goods in which knowledge is not a sufficient protection to consumers. She also raised the knotty question of how far the government (or the code authorities) ought, ideally, to go in attempts to remodel consumer purchasing habits in their own "best interests."

Section K sponsored jointly with Section O a program on "Land-Use Planning." The report of these sessions will be made under the latter section.

Section A, the American Mathematical Society, the Econometric Society and the American Statistical Association met jointly with the section on Wednesday afternoon. Professor E. B. Wilson presented a

simplified, complete solution of Boole's "Challenge Problem"—an indeterminate problem in probabilities in two independent variables. The solution was obtained, in part, by means of Yule's fourfold association tables. In his discussion of this paper Professor James V. Uspensky suggested that the solution might also be obtained by identifying and solving the fundamental inequalities within the system of simultaneous inequalities presented by the problem. This method leads to defining a polygon within which all points satisfy the conditions of the problem.

John M. Thompson presented a mathematical formulation of the theory of production stages found in Hayek's writings and specified conditions under which Hayek's conclusions would be valid.

Professor Dunham Jackson segregated certain portions of the theory of small samples that are amenable to routine demonstration not involving the special difficulties of probability and of statistical interpretation. The characteristic operations consist of the calculation of secondary frequency functions from given frequency functions and of evaluating integrals involving these functions. By this means he obtained such quantities as the standard deviation of a mean and the mean of the squares of the standard deviations of samples drawn from arbitrary distributions.

Mathematical investigations of demand for a commodity, expressed as a function of a system of unit prices, have for some time been on the verge of becoming practically useful. Professor Harold Hotelling illustrated, by means of imposing the condition of a limited budget, the possibilities of developing this branch of mathematical economics into a working tool in realistic economic problems.

Detailed notes on the Thursday and Friday programs of the American Statistical Association and of the Econometric Society will be published in the October numbers of the journals of these societies.

In the "Land-Use Planning" conference, a joint meeting of Sections K and O, from 70 to 90 persons listened to and discussed papers by L. C. Gray, of the U. S. Department of Agriculture, L. Dudley Stamp, of London, W. C. Lowdermilk, of the U. S. Department of Agriculture, M. R. Benedict, of the University of California, C. L. Alsberg, of Stanford University, C. R. Ball, of the University of California, Paul A. Eke, of the University of Idaho, David Weeks, of the University of California, Rex Willard, of the University of Washington, C. F. Shaw, of the University of California, and S. B. Shaw, of the U. S. Department of Agriculture.

Gray traced the objectives of land policy in the United States and pointed out that the objectives of the present policy are not entirely clear cut. They embody not only surplus control at the moment but

such long-time objectives as reduction of soil erosion, improvement in the social and economic status of the human beings involved, reduction of costs of local government and the promotion of land-use planning in a broader way.

Stamp outlined the British land-use survey, which "aims to find out how every acre is now used" and is basic for later planning activities.

Lowdermilk pointed out that erosion is wasting soils at an alarming rate as the natural vegetation of thousands of years is removed, and discussed research under way to combat erosion.

Benedict pointed out that we need studies of comparative advantage, studies of a sociological nature, if people are to be shifted to new occupations, and studies of costs of government.

Alsberg pointed out that geniuses capable of original work can not usually be "organized," that they work best under a *laissez-faire* policy, that "universal education increases the number of those from whom the leaders . . . of intellectual endeavor may be recruited," but that for some types of work requiring no new and original ideas "research may be organized cooperatively or autocratically."

Ball pointed out that political science problems of land-use planning "involve the entire question of the rights of the individual as compared with the right of society . . .," including all that is involved in such phrases as *laissez-faire* and "rugged individualism." They involve also types of local government to be used and degree of responsibility of state and federal governments.

Eke raised the question of where families now stranded in poor areas are to go. A second problem is how to induce them to leave friends, relatives and associations, even if a place to go is found. Another obstacle to shifting populations is "local pride, local business houses and public institutions."

Weeks described a study of the Sierra Nevada foothills and showed how cooperative effort was needed and obtained both in the research and in planning to maintain a satisfactory combination of agriculture and industry in the area.

Willard outlined the land-use program of the state of Washington. Its objectives are: First, "a determination of land quality . . . so that a reliable basis for permanent rural rehabilitation may be brought about"; second, "a determination of the best ultimate use of the land"; third, "to give assistance and direction to government officials . . . leading to some solution or improvement in the tax problem."

Shaw described the make-up of an index of soil productivity and its use in land classification.

Show explained the need for zoning in land-use planning.

SECTION ON HISTORICAL AND PHILOLOGICAL
SCIENCES (L) AND ASSOCIATED SOCIETIES

(Report from Chauncey D. Leake)

Sections L and N (Medical Sciences) held a joint session on the morning of June 22. A symposium on the Hearst Medical Papyrus, which was exhibited in the University of California Library, was given under the chairmanship of Professor C. D. Leake. Professors A. L. Kroeber and E. W. Gifford, of the University of California, gave a physical description and discussed the methods of preservation of the papyrus. Dr. H. F. Lutz, of the University of California, discussed the philological position of the papyrus and its significance in the introduction of Egyptian sciences. Dr. S. V. Larkey, of the University of California Medical School, discussed the relation of the Hearst Medical Papyrus to other medical papyri and its position in the history of medicine. Following this symposium Dr. A. W. Meyer, Stanford University, presented an illustrated paper on Harvey's "de Generatione" (1651).

In the afternoon Section L combined with the History of Science Society and the Linguistic Society of America in a joint program, under the chairmanship of Professor C. D. Leake, vice-president of the History of Science Society. Dr. F. E. Brash, of the Library of Congress, was in attendance at the meeting. Professor James Westfall Thompson, of the University of California, discussed "The Influence of Science in the Nineteenth Century on the Writing of History." Professor Olaf Larsell, of the University of Oregon, gave an illustrated biographical sketch of Berzelius. Professor C. A. Kofoed, of the University of California, discussed the question, "To What Extent Did William Charles Wells Anticipate the Ideas of Charles Darwin on Natural Selection?" Thomas Cowles, of the University of California, offered a paper on "Malthus, Darwin, and Bagehot: A Study in the Transference of a Concept." F. R. Johnson, of the Johns Hopkins University, discussed "The Relation of Thomas Digges to Astronomy in Sixteenth Century England." Dr. Elmer Belt, of Los Angeles, spoke on "The Influence of Edison's Cold Electric Lamp on the Progress of Urology." Peveril Meigs III, of Chico, presented a paper on "The Scientific Observations of the Dominican Missions of Lower California." The last part of the program was devoted to a symposium on linguistics in which the following papers were offered: "The Speech Consciousness of the Ancient Near Eastern Peoples and Its Significance in the History of Culture," by Professor H. F. Lutz, of the University of California; "Analysis and Synthesis and the Use of Greek Words in Natural Knowledge," by Professor W. E. Ritter, of the Uni-

versity of California; and "Every-day Figures of Speech," by Professor W. H. Davis, of Stanford University.

In connection with the joint meeting of Section L and the History of Science Society, Professors Herbert McLean Evans and James Westfall Thompson, with the assistance of Mr. and Mrs. Thomas Cowles, arranged an exhibit of first editions of epochal achievements in the history of science which was displayed at the University of California Library. Professor Evans prepared a special check list of the volumes shown in the exhibit, copies of which may be obtained from the University of California Press for thirty-five cents.

SECTION ON ENGINEERING (M) AND ASSOCIATED
SOCIETIES

(Report from B. M. Woods)

The value for engineering societies of affiliation with the American Association for the Advancement of Science probably lies chiefly in the opportunities afforded at the large summer and winter meetings for engineers to come into direct contact with those who are in large measure responsible for the progress of the sciences upon which engineering depends. This was exemplified in the Berkeley meeting in many ways, most obviously, perhaps, in the opening lecture by Professor Joel H. Hildebrand on "The Liquid State." Since the aeronautic and hydraulic divisions of the American Society of Mechanical Engineers planned to devote the two sessions of the following day to joint consideration of problems of fluid mechanics, Professor Hildebrand's timely review of the current state of our knowledge of the liquid state proved an admirable introduction.

The activities of Section M consisted of joint meetings of the aeronautic and hydraulic divisions of the American Society of Mechanical Engineers, sponsored also by the Institute of the Aeronautical Sciences, and of meetings of the section of hydrology of the American Geophysical Union, of the Pacific Coast Section of the American Society of Agricultural Engineers and of the Western Inter-State Snow Survey Conference.

The plan to devote the opening day to joint sessions on the subject of fluid mechanics marked a new development. As an examination of the program will show, the papers covered many types of flow and the problems associated with them. For example, Professor von Kármán reviewed the technical aspects of the turbulence problem, Professor Bakhmeteff the investigation of dynamical similarity in open channel flow. Other speakers discussed such widely varying topics as special characteristics of mud fluid flow,

capillary potential theory of flow in soils, recent progress concerning the aerodynamics of wing sections and experimental cavitation studies at the Massachusetts Institute of Technology. The synthesizing influence of fluid mechanics in the treatment of these many-sided problems was apparent and was recognized throughout. Parallel sessions in aeronautics, hydraulics, hydrology and snow survey were the order for the remaining days of the meeting.

As a matter of general interest, Elmer A. Sperry delivered a public address on "The Automatic Pilot," which was enthusiastically received. This was arranged in response to the general interest of the contributions of the gyroscope to ships as well as to airplanes. It was intended to present the latest developments as well as the problems remaining unsolved.

On Wednesday evening, June 20, the Daniel Guggenheim Medal for achievement in aeronautics was presented to William Edward Boeing, of Seattle, at a formal dinner at the Engineers' Club of San Francisco. The formal presentation was made by Major E. E. Aldrin, president of the Daniel Guggenheim Medal Fund, Incorporated, and chairman of the Committee on Awards. Among the many outstanding achievements in aviation, due to the pioneering and leadership of Boeing, the following may be mentioned as most significant. Fifty-six different types of airplanes have been built by his company during the seventeen and one-half years just past for commercial, private and military use—a total of more than eighteen hundred airplanes. The company was in many ways a pioneer. It was the first to use air-cooled engines for commercial and defense planes and the first in the United States to adopt the steel-tube fuselage developed by Fokker. The Boeing Transport Company was the first to fly passengers at night on regular schedule over long distances, the first to operate tri-motored passenger transports over long distances at night and the first to be fully equipped with two-way radio telephones. Further, the Boeing plant has built the greatest number of pursuit aircraft produced by any manufacturer since the war. These army and navy fighting planes have incorporated features of design and construction which, according to air corps officers, have enabled this country to possess the fastest single seater standard military aircraft. The citation read, "For successful pioneering and achievement in aircraft manufacturing and air transport."

A significant feature of the professional meeting was the whole-hearted cooperation of Pacific Coast sections of the American Society of Mechanical Engineers and of universities in the Pacific Coast area. It will be noted in the program that prominent uni-

versities of Washington, Oregon, California, Arizona, etc., are represented. In the same spirit the aeronautic-hydraulic programs of the first two days were held on the Berkeley campus of the University of California, those of the third day on the campus of Stanford University.

The important excursion of the meeting was that to the Sunnyvale Air Base and the *Macon* on the afternoon of June 21, following the morning sessions at Stanford University.

The program committees are especially to be congratulated on their success in preprinting and binding in a single cover the entire set of papers presented at the aeronautic and hydraulic division meeting. The papers so prepared, with illustrations, amount approximately to a 750-page book, condensed by the offset printing process to approximately 200 pages. The availability of the papers made both presentation and discussion easier and more profitable.

As a possibility for a future meeting, it is suggested that consideration be given to a joint session between some one of the engineering societies or divisions and the sections on physics, chemistry or mathematics, at which consideration of both the theoretical and applied aspects of some important division of fundamental science can be undertaken.

SECTION ON MEDICAL SCIENCES (N) AND ASSOCIATED SOCIETIES

(Reports from Earl B. McKinley, John N. Force, M. L. Tainter and C. M. Haring)

The program of Section N consisted of four general fields of interest—(1) endocrinology, (2) nutrition, (3) hygiene and epidemiology and (4) parasitology. Joint sessions were held with the American Society of Parasitologists and the Historical and Philological Sciences (Section L). The first session was preceded by a memorial service in honor of the late Dr. William H. Welch, who was chairman of Section N in 1902, was president of the association in 1906 and served for some time as a member of the executive committee of the association. Dr. J. McKeen Cattell presided at the memorial service, and Dr. Ray Lyman Wilbur, president of Stanford University, gave an address on the life and work of Dr. Welch.

The first session on endocrinology was a symposium on the general subject, "A Survey and Evaluation of the Present Status of Endocrine Investigations." Dr. E. M. K. Geiling, of the Johns Hopkins University, discussed "Present Problems in Endocrinology," Dr. Vincent du Vigneaud, of the George Washington University, discussed "The Present Status of the Chemistry of the Hormones from a Structural Standpoint," and Dr. J. M. Luck, of Stanford University,

spoke on "Inter-relationships of the Endocrine Glands."

At the second session on endocrinology, papers were presented on the normal variation of estrin in the blood of women and on the growth of intraocular endometrial transplants in the rabbit during pregnancy. The relationship of the pituitary gland to ketonuria was also discussed. That depancreatized dogs could be maintained for as long as three years with insulin without the feeding of raw pancreas was shown. It was found, however, that the incidence of cataract was very high in these animals and that lipid metabolism was affected. The relationship of the parathyroid hormone to the calcium and magnesium in the blood stream was also considered.

In the session on nutrition a number of very interesting papers was presented. It was shown that there was a decrease in retention of calcium and phosphorus with the ingestion of fluoride. Vitamin A deficiency in cattle confined to dry range feed, dietary deficiency in planaria and vitamin C deficiency in guinea-pigs were considered in a series of presentations. Progress in the preparation of potent vitamin G concentrates from liver was reported. The vitamin and mineral deficiencies in the diets chosen by a group of families on relief was considered. Significant deficiencies in iron, vitamin C and vitamin B predominated in these diets. Work tending to show separate mechanisms for gastric motility and gastric secretion was also presented in this session. The theory that blood sugar level controls gastric hunger contractions was questioned. The probable accuracy of the prediction of basal metabolic rate calculated from surface area, pulse pressure and pulse rate was presented. Evidence that estrin of pregnancy urine in mares is derived from fetal placenta was also reported.

At the first session of Section B on "Epidemiology, Parasitology and Biometry," papers were presented on the recent advances in the study of whooping cough, transmissibility of the common cold, the epidemiology of psittacosis and the bacillary dysentery. A paper on the thermal death point of growing and functioning cells was also presented.

At the second session papers were presented on equino-encephalomyelitis virus, pneumococcus infection, the plague, vaccinia virus and on secondary cases of certain communicable diseases among non-immune family contacts.

At the joint session with the American Society of Parasitologists, the pathology and transmission of *Trichomonas vaginitis* and inoculation experiments with *Trichomonas vaginalis*, *Trichomonas hominis* and *Trichomonas buccalis* were presented. Papers concerning the nematode eye worm of dog and man, American trypanosomiasis, argasine ticks and intes-

tinal protozoan were also reported. A joint session was also held with Section L for a symposium on the Hearst Medical Papyrus.

The Pacific Coast Branch of the Society for Experimental Biology and Medicine met on Thursday afternoon and evening with a dinner intervening. A total of 25 papers was presented which will be published in the *Proceedings* of the society and other scientific journals.

The California State Veterinary Medical Association held several sessions. Contributions to pathology and related sciences were contained in papers by Professor L. R. Vawter and Professor Edward Records, of the University of Nevada, on the "Transmission and Dissemination of Equine Encephalomyelitis"; by H. A. Hoffman, of Petaluma, California, on "Poultry Mortality as Reflected in Three Years of Diagnostic Records"; and by E. E. Houchin and T. J. Niemeyer, of Los Angeles, California, on the "Blood Picture in Small Animal Diseases."

Recent contributions of entomology to veterinary science were given in papers by Professor W. B. Herms, of the University of California, on "Mosquitoes as Vectors of Equine Encephalomyelitis"; Professor Stanley Freeborn, of the University of California, on "The Field of Veterinary Entomology"; and Charles R. Schroeder, of San Diego, California, on "The Snake Scale Mite."

A paper on the "National Control of Bang's Disease" by Professor C. P. Fitch, of the University of Minnesota, presented recommendations for standardizing the technique of the agglutination test. This, with discussion by Dr. F. M. Hayes, University Farm, Davis, J. G. Townsend, of Los Angeles, A. G. Gierke, of Sacramento, and Professor K. F. Meyer, of the Hooper Foundation for Medical Research, constituted a symposium on *Brucella* infections in man as well as in cattle, swine and goats.

Papers on the economic, educational and historical aspects of veterinary science were given by F. A. Taylor, of Sacramento, on the "Activities of the Bureau of Vocational Standard"; M. J. O'Rourke, of San Francisco, on the "Practice of Veterinary Medicine as an Art and as a Business"; and Joseph M. Arburua, of San Francisco, on "The Early History of Veterinary Education in the United States."

A contribution chiefly of biological interest was that by Donald R. Skillen, of Los Angeles, on "Ornithology and the Veterinarian."

SECTION ON AGRICULTURE (O) AND ASSOCIATED SOCIETIES

(Report from J. C. Martin and Frank N. Briggs)

The Western Society of Soil Science held six half-day sessions. During the first two days, papers dealt with soil physics, soil chemistry and soil-plant-mois-

ture relationships. Papers on soil-plant-moisture relationships centered around the question as to whether there is a definite wilting point or a wilting range. Two papers dealt with the solid phase-liquid phase equilibria of bases, notably the calcium-sodium relationship; one paper with the exchangeable bases of soil colloids in relation to grinding. The direct application of anhydrous ammonia to the irrigation water was reported as a source of nitrogen fertilizer. The last two half-day sessions were devoted to a symposium on soil phosphate, eight papers on this subject being given. One paper dealt with fixation of added phosphate in soils generally. Two papers discussed the question from the standpoint of the calcareous soils of Arizona, the reaction of which is about pH 8.1 to 8.5. The important factor of CO_2 evolution by plant roots and its reduction of the pH in the root-soil contact zone was emphasized. Determinations of inorganic phosphate in green plant tissue as a measure of available phosphorus in soils was discussed. During the vegetative stage a striking direct relationship was seen between plant content and available supply in the soil. In four species of fruit trees application of nitrogen over a five-year period has reduced the phosphorus content of the leaves. In Montana application of phosphate to soil has served the twofold purpose of providing phosphorus and aiding the legumes in fixing atmospheric nitrogen.

The dinner of the society, held on Monday evening, and well attended, was devoted to business. The following officers were elected for the coming year: *President*, T. F. Buehrer, University of Arizona; *Vice-president*, D. S. Jennings, Utah Agricultural College; *Secretary-Treasurer*, H. D. Chapman, University of California, Citrus Experiment Station.

The eighteenth annual meeting of the Western Branch of the American Society of Agronomy was held in four sessions. The first session consisted of contributed papers dealing with soil and soil moisture in relation to the production and quality of crops.

Wednesday morning some papers related to the growth and handling of alfalfa in relation to yield in quality; others dealt with the injuries of seed by thrashers in relation to germination and growth of crops.

The Thursday morning meeting was a joint session with the Genetics Society of America. Contributed papers on genetic and plant breeding methods in relation to crop improvement are reported elsewhere.

The last session was a symposium on weed control, arranged as a joint meeting with Section O, Agriculture. This was the first symposium on weed control held under the auspices of the American Association for the Advancement of Science. It gave opportunity for a discussion of the principal investigations on weed control which have been conducted in the

western states. The states most active in weed control investigations are Utah, Idaho and California.

Up to a few years ago there had been no well-grounded fundamental studies of weeds and methods of control. Nearly every experiment station in the country has issued weed circulars and bulletins, but these have dealt with little else than descriptions of weeds and with only very general and sweeping suggestions as to methods of control and eradication. Field plots have been established by the thousands, but in the final analysis of the data derived therefrom nothing definite was forthcoming. The fight against weed pests has not made the progress that entomologists and plant pathologists have made in their struggle against insects, fungi and the various other causal agents of plant diseases. The latter have recognized the necessity for life history investigations and for basic morphological and physiological researches as a guide to methods of control and eradication. Real progress in weed control will result only from such fundamental, scientific investigation.

Papers by Professor D. C. Tingey, of the Utah State Agricultural Experiment Station, show various tillage methods were more efficient in the eradication of morning-glory, Canada thistle and perennial sow thistle than chlorate methods. In most of the western states too much emphasis has been placed upon the use of chemical means of weed control, to the exclusion of economic cropping methods.

In all the plot work using chemicals pronounced variations were noted in the results obtained. Carefully controlled greenhouse experiments by Dr. A. S. Crafts, of the University of California, showed that soils vary greatly in fixing power. There is great variation in the toxicity of these chemicals in different soil types, which exists not only for the chlorates but also for the arsenicals. Moreover, there are great differences in the loss of toxicity with time in the different soil types. Dr. Crafts has employed a biological test which gives a direct measure of the toxicity of the reagent without resort to chemical analyses.

Margaret K. Bellue, of the California State Department of Agriculture, Sacramento, described a new means of dissemination of nut grass. The rhizomes of nut grass penetrate the tissues of developing potato tubers and within the tissues of the tuber full-grown, viable nuts are formed. Thus this weed is disseminated in shipments of potatoes.

On Saturday morning the society met at Davis for an inspection of the agronomic experiments on the University Farm.

The following officers were elected: Professor B. A. Madson, University of California, *president*; J. F. Martin, U. S. Department of Agriculture, *secretary*. The 1935 annual meeting will be held at the Agricultural Experiment Field Station, Pendleton, Oregon.

SECTION ON EDUCATION (Q)

(Report from Noel Keys)

Four half-day sessions, each devoted to a common theme, were followed by two joint sessions with Section I and the Western Psychological Association, reported elsewhere. In the Wednesday morning symposium on "Difficulties in Reading" four papers were presented. Professor Peter L. Spencer, of Claremont Colleges, reported the failure of seventeen tests to disclose any consistent tendency in kindergarten to second grade children to favor the use of one hand, eye or foot over the opposite member. He did, however, find superior reading discrimination on the part of the exophoric child. Sixteen hundred seventh grade children tested over a fourteen-month interval showed better than average progress in reading on the part of the myopic and below normal progress for those suffering from hyperopia or strabismus, according to Principal L. P. Farris, of Oakland High School. Dr. Grace Fernald, of the University of California at Los Angeles, in presenting the remarkable result obtained with extreme cases of reading disability through utilization of motor imagery, suggested that the current practise of requiring reading in advance of writing instruction is accountable for many of the difficulties of this problem group. Dr. W. M. Danner, Jr., of Stanford University, testified to the striking improvement in reading skill of university students resulting from the provision of individual observation and tuition periods for those below standard.

The Tuesday afternoon session was devoted to investigations in subjects other than reading. Irving Melbo, of the University of California, reported senior students in small California communities equalling if not excelling those in metropolitan high schools in information on current social issues, with boys excelling the girls. Dr. L. C. Gilbert, of the University of California, summarized experiments evidencing the significant rôle of reading in the improvement of spelling on high-school and college levels. Miss Velma Woods and Mr. Wyman Olson, both of the University of California, analyzed, respectively, the arithmetic errors of teachers of college students in four states and the inability of university students in education to interpret critically the experimental literature in their field.

In the Wednesday morning session on problems of maturation Professor E. A. Lincoln, of Harvard University, presented an admirable account of the Harvard Growth Study, now completing its twelfth year, with a résumé of the seventeen doctoral dissertations which have already resulted. His conclusion was that growth and growth curves are highly specific, so that the individual differs not only from others of his kind, but from himself at other periods. This thought was carried further by Mr. Hubert Armstrong, of the Oakland Department of Child Welfare, who called attention to certain fallacies in the indiscriminate application of the mental age concept. Dr. Helen Pryor, of the University of California, then presented data as to physiological aspects of adolescent development in girls, as obtained from the California Adolescent Study. The close association of the broader body build with early onset of catamenia was particularly striking.

Wednesday afternoon was given over to investigations bearing on leadership and responsibility in school pupils, with Superintendent E. A. Lee, of San Francisco, presiding. Professor Floyd Caldwell, of the Chico State Teachers College, made clear the tendency for prestige to spread far beyond the limits of the individual's special competence. College students, for example, rated General Pershing not far below Einstein as an authority on mathematics. Dr. Marion Brown, of the University of California, pointed out that the more prominent leaders in student activities of University High School were characterized by superior intelligence, scholarship and appearance, and younger than the average of their group. Professor Noel Keys, of the University of California, in reporting on some three hundred students who have entered the university over a nine-year period under the age of sixteen and a half, showed these not only to have excelled in scholarship and attendant honors, but to have participated in more than the average number of activities and made generally favorable adjustments. The wide variety of practises prevailing with regard to the extent of freedom allowed, and the opportunity afforded for the exercise of responsibility on the part of students in different types of schools was revealed by a survey conducted by Dean Grayson N. Kefauver, of Stanford University.

OBITUARY

RICHARD THORNTON FISHER

RICHARD THORNTON FISHER, head of the Harvard Forest School and director of the Harvard Forest since their inception in 1903, died suddenly of a heart attack on June 9.

Dr. Fisher was graduated from Harvard University in 1896. Shortly thereafter he entered the Bureau of Forestry where, under Gifford Pinchot, he greatly furthered the Napoleonic campaign of setting aside the vast areas which now form the bulk of the Na-

tional Forests in the western states. He took his master's degree at the Yale Forest School in 1902 and followed this with study abroad. On his return, President Eliot selected him to head the new Harvard Forest School. His unceasing devotion, his thorough knowledge and his quiet courage and persistence have given us the Harvard Forest at Petersham, Mass.—a managed forest, nearly self-supporting and rich in opportunity for students of conservation and nature.

His death was a great and sudden shock. He was seemingly in the prime of life the day before. He was a pioneer in his field at a time when scientific forestry was distinctly a novelty in this country, yet he never claimed too much. His enthusiasm was not boisterous, nor his courage aggressive, yet he possessed a quiet persistence and depth and sincerity of feeling that won many to faith in his work.

"Dick" Fisher was liked by all who knew him and loved by those privileged to closer intimacy. His interests were many; he was fully aware of the poetic and romantic side of forestry, and his knowledge of scientific matters was rivaled in no small measure by his interest in wild life, especially birds. Yet he was so unassuming that close acquaintance was essential to proper appreciation of the great breadth of his knowledge. He was probably the greatest silviculturist of the present era.

Whatever he did he did well. There were no half-way measures in his make-up. Despite his numerous activities and interests, he would meet each new situation in the same quiet, perceptive, fair-minded and occasionally half-humorous fashion. Many will grieve over his passing; particularly those of us who were so fortunate as to have studied under him and who, deeply touched by his quiet sincerity and enthusiasm, will always carry with us the memory of a great teacher and a most gallant gentleman.

H. H. TRYON

THE BLACK ROCK FOREST

RECENT DEATHS

WILLIAM HULTZ WALKER, director and specialist in patents of the Dewey and Almy Chemical Company at Cambridge, Massachusetts, non-resident professor of chemical engineering at the Massachusetts Institute of Technology, was killed in an automobile accident on July 9. He was sixty-five years old.

DR. WILBUR MORRIS STEIN, electrical engineer, who from 1887 to 1909 held professorships successively in the Ohio University, the Armour Institute of Technology and Swarthmore College, died on July 4, at the age of seventy-one years.

DR. GREGARIO M. GUITERAS, until his retirement in 1927 surgeon in the Public Health Service, known for his work on yellow fever, died on July 5, at the age of seventy-one years.

JOHN E. STOCKER, associate professor of mathematics at Lehigh University, died on July 5, at the age of sixty years.

DR. ARTHUR PRINCE CHATTOCK, emeritus professor of physics at the University of Bristol, known for his work on the movement of gaseous ions and the measurement of small pressure differences, died on July 1 at the age of seventy-three years.

M. G. FOSTER, son of Sir Michael Foster and author of numerous papers on balneology and climatology, died on June 16, at the age of sixty-nine years.

THE REV. GIUSEPPE GIANFRANCESCHI, S.J., director of the radio station and of the ultra short-wave apparatus at the Vatican, formerly director of the Gregorian Academy of Sciences, and since 1921 president of the Pontificia Accademia delle Scienze, died on July 9, at the age of fifty-nine years.

MEMORIALS

A PORTRAIT of the late Professor David S. Kellicott, first director of the Lake Erie Laboratory of the Ohio State University, was presented to the laboratory at its opening session. The memorial was arranged for by his daughter, Miss Gertrude Kellicott, prior to her death in July, 1932.

ACCORDING to the *Journal* of the American Medical Association, in memory of the late Dr. Hideyo Noguchi, of the Rockefeller Institute for Medical Research, a hall will be built on the site of the cottage where he was born beside Lake Inawashiro in north-eastern Japan. The committee aims to collect 100,000 yen to erect the hall and to repair the old house where his parents and brothers and sisters lived. In the hall will be kept various articles he had used, some sent back from America. Marquis Okuma and Dr. Shinjyo, president of the Kyoto Imperial University, are members of the committee.

THE Post Office Department at Colon, Panama, has announced that a new three-cent stamp in honor of General Goethals will be issued on August 15, the twentieth anniversary of the opening of the Panama Canal to commercial traffic. Three million copies will be printed by the Bureau of Engraving and Printing in Washington to replace the current United States three-cent stamp. The design for the new stamp has been approved by Colonel George R. Goethals, son of the builder of the canal.

ACCORDING to *Nature* the Soviet postal authorities have issued a series of new postage stamps to commemorate the centenary this year of the birth of Mendeléeff. The new issues are of five, ten, fifteen and twenty kopek denominations. The five and the twenty kopek denominations bear a design of the Mendeléeff

monument against a background of his table of the periodic system of elements; the ten and fifteen kopek denominations bear a portrait of Mendeléeff, also against a background of the table of the periodic system of elements. All the stamps bear the commemoration date 1824-1934.

The British Medical Journal states that the issue of the *Schweizerische medizinische Wochenschrift* for June 9 is a Festschrift in honor of the centenary of the foundation of the University of Berne, and contains portraits of the most distinguished professors of the medical faculty during the last hundred years.

SCIENTIFIC EVENTS

THE BRITISH NATIONAL PHYSICAL LABORATORY

THE General Board of the National Physical Laboratory held its annual inspection of the laboratory on June 26, when about 2,500 guests were received by Sir Frederick Gowland Hopkins, chairman of the board, and Sir Joseph Petavel, the director.

According to an account given in the *London Times*, the new acoustics laboratory was open for inspection for the first time. Here unrivaled facilities are offered for the study of sound, which owing to modern conditions of life is becoming an increasingly important problem. It was pointed out that not only is noise increasing at the source, but modern buildings are becoming more and more pervious to it. The steel frame of a big modern building provides a continuous structure through which sound can be easily transmitted, while the walls are so thin that they readily admit sound. At the same time the heavy hangings and furniture of Victorian days, which used to deaden sounds, are not in favor to-day.

These and other problems are being studied at the National Physical Laboratory. A room in which no two walls are parallel and in which the ceiling is at an inclination to the floor provides that sound in it is uniformly distributed, thus ensuring ideal conditions for experiment. The room is carried on cork pads and encased by two sets of walls, so that extraneous sounds are not admitted. In these conditions a sound made in the room reverberates for a long time. But if two steel doors in a wall are opened so as to expose an absorbent material, *e.g.*, asbestos, the sound does not reverberate for so long. In this way it is possible to arrange wall materials in the order of their sound-absorbing powers.

Another experiment in the same building shows how a double window, if properly spaced, will deaden such irritating noises as the clanking of a dust-bin, but the astonishing result has emerged that if the sheets of glass are not properly spaced the effect may be to increase the sound, as compared with the sound transmitted by a single sheet.

The Radio Department showed an instrument devised at the laboratory to give warning on board ship at the approach of other ships in fog. Although this is actuated by wireless signals, its operation does not

prevent ordinary wireless telegraphy, even on the same wave-length. The indicator consists of a glass disk marked "fore and aft," "port and starboard." Wireless signals from a neighboring ship (which may be as short as 1-100 sec. in duration) cause a luminous line to flash out on the disk in the direction of that ship. If the neighboring ship is approaching the observing ship, the length of the line increases. If the ships are heading for a collision, the direction of the line remains fixed. The instrument immediately indicates any change in the direction of the approaching ship by a change in the direction of the indicating line.

Another instrument developed in the Radio Department indicates automatically, by the lighting of a red or green lamp, the instant a ship deviates from a set course. Known methods of remote control can be incorporated to ensure that the deviation from the course is automatically corrected. This invention should be of great utility in flying as well as at sea.

THE LEVERHULME FELLOWSHIPS

AWARDS of Leverhulme Research Fellowships in 1934, and grants to research workers, are announced by the Advisory Committee, and are given in the *London Times* as follows. The number of applications for awards this year was approximately the same as in 1933. The Advisory Committee has recommended and the trustees have approved twelve nominations to fellowships, tenable for varying periods up to two years. Three fellowships awarded last year have been extended for a further period of one year.

On the recommendation of the Advisory Committee the trustees have also approved the award of nine grants to research workers to assist the completion of their programs. These grants are held under the same general conditions as the fellowships.

The names of the fellows and the subjects of the researches in so far as they concern the sciences are as follows:

- E. Ashley Cooper, D.Sc., lecturer in chemistry, University of Birmingham, "The Activity of Enzymes of Bacteria."
- E. E. Evans-Pritchard, Ph.D., assistant professor of sociology, University of Cairo, Egypt, "A Detailed

Ethnological and Sociological Study of the Pagan Galla of Western Abyssinia."

R. MacLagan Gorrie, D.Sc., Indian Forest Service, "The Correlation of Erosion Damage and Grazing in Forest Lands."

Miss M. M. Green, late Government Education Department, Nigeria, "Anthropological and Linguistic Research among the Ibo Tribe of Southern Nigeria." (Joint research with Mrs. S. H. Leith-Ross.)

D. Ll. Hammick, fellow and tutor, Oriel College, Oxford, Leverhulme Research fellow, "Investigation on the Interaction of Nitrocompounds with Aromatic Bases and Hydrocarbons." (Renewal.)

H. Stafford Hatfield, Ph.D., Leverhulme Research fellow, "The Behavior of Crystalline Substances in Electric and Magnetic Fields." (Renewal.)

N. E. Odell, associate of the Royal College of Mines, geologist to the Louise A. Boyd Expedition to North-East Greenland, 1933. "An Investigation into the Structure and Metamorphism of the Franz Josef Fjord Region of North-East Greenland."

W. H. Taylor, Ph.D., assistant lecturer in physics, University of Manchester, "The Application of the Method of X-ray Analysis to the Investigation of the Structures of Organic Compounds."

Grants in aid of research were made to C. R. P. Diver, M.A., Senior Clerk, House of Commons, "South Haven Peninsula Survey, Studland Heath, Dorset; (i) Physiography and history; (ii) Distribution of populations and ecology of several animal orders," and to Mrs. C. F. Tipper, D.Sc., research worker, University of Cambridge, "The plastic deformation of metals."

REORGANIZATION OF THE U. S. BIOLOGICAL SURVEY

CHANGES in the organization of the U. S. Biological Survey looking toward the more effective promotion of an active national movement toward wild-life restoration have been announced by J. N. Darling, chief of the bureau.

Consolidating the Division of Game and Bird Conservation and the Division of Predatory Animal and Rodent Control, a new unit, called the Division of Game Management, has been established. Under the leadership of Stanley P. Young, formerly head of the control unit, eight to twelve regional directors will administer game and other wild-life management throughout the states. Leaders of predatory and rodent control, refuge custodians, law-enforcement officers and other field agents will be responsible to the regional directors.

To keep the public acquainted with the accumulating facts and findings and with the activities of the survey, a Division of Public Relations has been established and has been placed in charge of H. P. Sheldon, formerly head of the Division of Game and Bird Con-

servation. In addition to giving attention to the press, the radio, public exhibits and public speakers, the new division will keep watch of the relations of the bureau with the various regions and states. It is planned to give more opportunity to investigators to write about their specialties. The Division of Public Relations includes a consolidation of the Office of Editorial and Informational Work and the Office of Exhibits, Photographs and Publication Distribution.

To promote a national migratory waterfowl program, Mr. Darling has established a new unit to be called the Division of Migratory Waterfowl. In charge of J. C. Salyer, of the University of Michigan, this division will plan for careful and thorough wild-life-refuge administration in the interests of the birds, the public and the sportsmen. Immediate objectives will be emergency acquisition of refuge areas with the special funds available, and the development of trained refuge custodians. For the present, however, existing refuges remain under the supervision of the Division of Game Management.

The duties and personnel of the Division of Administration have been amplified, placing the enlarged unit in charge of W. R. Dillon, formerly assistant in the Division of Game and Bird Conservation.

SEARCH FOR PLANTS TO CONTROL SOIL EROSION

PLANT explorers of the U. S. Department of Agriculture are now making an intensified search at home and abroad for plants that will help to control soil erosion. Two parties are abroad—one in Russia and one in Japan—and other parties will search the western half of the United States.

H. L. Westover and C. R. Enlow will visit Russian Turkestan, Persia and Afghanistan, looking for all kinds of soil-holding plants which show possibilities for the Southwestern United States. Five years ago Mr. Westover spent a year in Turkestan and Persia and brought back several strains of wilt-resistant alfalfa which are being used to build up resistance to this disease in our domesticated alfalfas.

The Russians, according to Knowles A. Ryerson, chief of the Bureau of Plant Industry, have a highly developed program of plant introduction under the direction of N. I. Vavilov, who is also head of the Agricultural Academy at Leningrad. A party of Russian horticulturists has been in the United States since the first of the year, studying our citrus industry. Two years ago when the department had two men in South America for a few months searching for disease-resistant potatoes to use in breeding work the Russians had several men there for a year for the same purpose. The second party of foreign plant explorers, including H. G. MacMillan, a veteran plant explorer, and J. L.

Stephens, a forage crops specialist, is now in Japan. They expect to cover as much territory in the Far East as possible during the next eighteen months. They will search for plants in the fringes of the Hingan Mountains, a region which has never been explored for grasses. Frank Meyer, of the department, was there many years ago in search of fruits. Because of the extremes in temperature in this region it is hoped that the search will yield promising plants. While both groups will be particularly interested in plants that can be used to prevent soil erosion, they will also collect seeds and fruits of any other plants, especially promising trees and shrubs.

The hunt for useful wild plants in the United States is the first correlated effort to make the beginning on a nation-wide inventory of our own unused plants. For this reason it is hoped that valuable plants may be found in the United States. Workers at the state experiment stations and those employed by the Department of Agriculture have frequently discovered and domesticated valuable wild plants, but such work has been incidental. One party of ten trained botanists is at work in Washington and Oregon. Another group will soon begin work in Arizona and New Mexico. Other parties will work in Texas and Oklahoma and in North Carolina and Tennessee.

THE CLEVELAND MEETING OF THE AMERICAN CHEMICAL SOCIETY

MORE than 2,000 chemists and representatives of allied fields of science and industry will participate in the eighty-eighth meeting of the American Chemical Society to be held in Cleveland, from September 10 to 14, under the presidency of Dr. Charles L. Reese, of Wilmington, Del. The keynote of the meeting will be "Chemistry Catalyzes Commerce."

Progress in practically every field of chemistry will be reported in hundreds of papers, addresses and reports to be presented before various divisions. Leading industries, universities and technical schools, state and government services and private laboratories will send delegates.

The dramatic advances of chemistry during the depression will be set forth by well-known investigators. The sessions will deal with public health and sanitation, with gas and fuel, chemical education, rubber, medicine, fertilizers, industrial and engineering chemistry, petroleum, sugar, water supply, biological chemistry, cellulose, leather and gelatin and numerous other fields of pure and applied science.

The opening meeting, according to the preliminary program, will take place on Monday, September 10, at the Cleveland Hotel, when Professor Robert E. Swain, of Stanford University, will deliver an address on "Chemistry during the Depression." N. K. Chaney, V. C. Hamister and S. W. Glass, of the National Carbon Company, will speak on "Constants of Carbon at Arc Temperatures." Dr. J. R. Katz, of the Scheikundig Laboratorium of the University of Amsterdam, will present a paper on "X-Ray Spectrography of Swelling" and Dr. J. C. Hostetter, of the Corning Glass Works, will discuss "The Technique of Making Large Telescope Mirrors."

The Division of Agricultural and Food Chemistry, of which Dr. Donald K. Tressler, of Geneva, N. Y., is chairman, will hold a joint symposium with the Division of Biological Chemistry on "Chemistry of the Enzymes."

A symposium on "Modernizing the Course in General Chemistry" will be sponsored by the Division of Chemical Education, of which Professor R. A. Baker, of the College of the City of New York, is chairman. Educators from all over the country will participate in the discussion. Teachers from Cleveland and other cities in Ohio will present papers on the need of re-directing chemical education in schools and colleges.

Dr. W. H. McAdams, of the Massachusetts Institute of Technology, will preside at a symposium under the auspices of the Division of Industrial and Engineering Chemistry. A symposium by the Division of Medicinal Chemistry is being arranged by the chairman, Dr. Paul Nicholas Leech, of Chicago. Joint sessions are scheduled by the Division of Organic Chemistry and the Division of Physical and Inorganic Chemistry. Dr. C. S. Hudson, of Washington, D. C., is chairman of the Organic Division, and Professor Donald H. Andrews, of the Johns Hopkins University of the Physical and Inorganic Division.

The Division of Gas and Fuel Chemistry, headed by Dr. Harold J. Rose, of the Mellon Institute, Pittsburgh, is planning an extensive program, Cleveland being the center of leading research laboratories engaged in this field. The symposium before this division will be on the "Properties of Coal."

Friday, September 14, will be Akron Day. Members of the societies will visit Akron in a body to inspect the rubber and other industries under the direction of the Akron Section, of which G. K. Hinshaw is chairman.

SCIENTIFIC NOTES AND NEWS

DR. DAVID WHITE, of the U. S. Geological Survey, has been awarded the Boverton Redwood Medal by the Institution of Petroleum Technologists in London.

THE honorary degree of doctor of laws was conferred by the University of Edinburgh on June 28 on Dr. Theobald Smith, emeritus member of the Rocke-

feller Institute for Medical Research and from 1915 to 1929 director of the department of animal pathology at Princeton, New Jersey.

RUTGERS UNIVERSITY conferred on June 27 the degree of doctor of science on Dr. Charles B. Lipman, professor of plant physiology and dean of the Graduate Division of the University of California. In conferring the degree upon Dean Lipman, President Robert C. Clothier said: "Yours has been a life of exceptional usefulness in the science of soil chemistry and bacteriology, as well as in the art of education. You have contributed richly to the advancement of knowledge in these fields. Sensible of the great things you have already accomplished, we shall look forward*in the years to come to even greater achievements bringing credit to yourself, honor to your Alma Mater and benefit to mankind."

HONORARY degrees conferred at the commencement of Washington and Jefferson College included the degree of LL.D. on Henry A. Wallace, Secretary of Agriculture, and the degree of doctor of science on Dr. A. H. Logan, dean of the Mayo Clinic at Rochester, Minnesota.

THE Chamber of Commerce of Des Moines sponsored a public reception in honor of Dr. Walter L. Bierring on June 22 in recognition of his induction into the presidency of the American Medical Association. Dr. Bierring has been a member of the Chamber of Commerce for many years. Dr. John T. McClinck, of the College of Medicine of the State University of Iowa, chairman of the administrative committee, spoke in appreciation of Dr. Bierring.

THE Asiatic Society of Bengal has awarded the Barelay Memorial Medal for 1934 to Professor R. Row, of Bombay, "for conspicuously meritorious contributions to biological science with special reference to India."

Nature reports that the president and council of the Royal Society, London, have recommended Viscount D'Abernon, chairman of the Medical Research Council since 1929, for election into the society under the special statute which permits the election of "persons who in their opinion either have rendered conspicuous service to the cause of science, or are such that their election would be of signal benefit to the society."

DR. GEORGE C. SIMPSON, director of the Meteorological Office, London, has been elected a corresponding member of the Vienna Academy of Sciences.

DR. CHARLES E. SPEARMAN, who recently retired from the Grote professorship of psychology at the University of London, has been elected an honorary member of the German Society for Psychology.

WILLIAM H. BASSETT, metallurgical manager of the American Brass Company, Waterbury, Conn., has been elected president of the American Society for Testing Materials, and H. S. Vassar, laboratory engineer of the Public Service Electric and Gas Company, Irvington, N. J., has been elected vice-president.

At the thirteenth annual convention of the American Society of Clinical Pathologists, held in Cleveland from June 7 to 11, the following officers were elected: *President-elect*, Dr. F. M. Johns, New Orleans; *Vice-president*, Dr. B. S. Kline, Cleveland; *Executive Committee*, Dr. A. G. Foord, Pasadena, and Dr. Kano Ikeda, Minneapolis. The Ward-Burdick Medal was awarded Dr. R. R. Kracke for his work on agranulocytic angina. Drs. Ludvig Hektoen and Otto Naegeli were elected honorary members.

At the annual meeting of the Chicago Chemists Club, the following officers were elected for the year 1934-35: *President*, Frederick W. Sullivan; *First Vice-president*, Otto A. Sjostrom; *Second Vice-president*, Erich von Gebauer-Fuelnegg; *Secretary*, Robert B. Reynolds; *Treasurer*, Edward A. Dieterle; *Trustee*, C. D. Lowry, Jr.

DR. CHARLES JUDSON HERRICK, chairman of the department of anatomy, Division of Biological Sciences of the University of Chicago, becomes emeritus professor, having reached the retirement age. The administration of the department during the coming year has been referred to a committee consisting of Dr. George W. Bartelmez, Dr. Basil C. H. Harvey and Dr. Charles H. Swift. Dr. Herrick succeeded Dr. Robert R. Bensley, who became professor emeritus in 1933 after holding the position since 1906. Both Dr. Herrick and Dr. Bensley will continue their research in the Hull Laboratory of Anatomy.

DR. JOHN C. HESSLER, professor of chemistry at Knox College and at one time dean and acting president of James Millikin University, has been appointed president of James Millikin University to fill the vacancy created by the resignation on May 19 of Dr. J. H. White.

DR. P. F. TROWBRIDGE, director of the North Dakota College and Station since 1918 and previously connected with the departments of chemistry of the Universities of Michigan, Illinois and Missouri, retired on July 1. Dr. H. L. Walster, dean of the School of Agriculture, will become also director of the station.

DR. JOHN HOWARD FERGUSON, recently of Yale University, has been named assistant professor of physiology and pharmacology at the University of Alabama School of Medicine, succeeding Dr. Gene H. Kistler, who has been appointed associate pro-

fessor in the department of pathology and bacteriology.

DR. RALPH N. MAXSON, professor of inorganic chemistry at the University of Kentucky since 1909, has been made head of the department of chemistry to succeed Dr. F. E. Tuttle, who has reached the age of retirement.

DR. PAUL D. BARTLETT has resigned from the School of Chemistry of the University of Minnesota to accept an instructorship in organic chemistry at Harvard University. He will be succeeded by Dr. Alberto F. Thompson, Jr., who has spent the past year studying in Munich.

DR. ARTHUR W. WRIGHT, for the past four years director of a laboratory of pathology, has been appointed professor and head of the department of pathology at Albany Medical College to succeed Dr. Victor C. Jacobson, who recently resigned.

DR. ROBERT W. MORRISON, formerly assistant to the director of the Research Laboratories of The William A. Webster Company of Memphis, has been appointed adjunct professor of pharmacology in the University of South Carolina at Columbia, S. C.

DR. FRANZ BLUMENTHAL, extraordinary professor of dermatology and syphilology at the University of Berlin, has been appointed research professor of dermatology and syphilology at the University of Michigan Medical School for a period of two years. Dr. U. J. Wile is head of the department.

THE title of emeritus professor of bacteriology in the University of London was conferred on Dr. William Bulloch, on his retirement from the Goldsmiths' Company's chair of bacteriology at the London Hospital Medical College, and that of emeritus professor of ethnology on Dr. C. G. Seligman, on his retirement from the university chair of ethnology at the London School of Economics.

DR. OSKAR BAUDISCH, formerly at the University of Zurich, the Rockefeller Institute for Medical Research and Yale University, has been appointed research chemist and technical consultant of the Saratoga Springs Commission. On July 19 he left for Europe in order to continue his work on mineral, especially iron, metabolism, in association with Professor Hans von Euler, director of the Biochemical Institute at the University of Stockholm.

A. D. CONSTABLE, assistant director of electrical engineering of the British Admiralty, has been appointed director in succession to William McClelland. Mr. Constable was appointed assistant director of electrical engineering under Mr. McClelland in 1918. For many years he has been employed on electrical

design for the Naval Service, and latterly on research and experimental work.

DR. V. A. TIEDJENS, who has been scientific adviser to Yoder Brothers, Barberton, Ohio, for the past two years, has returned to the New Jersey Experiment Station to conduct research in vegetable gardening.

DR. RAYMOND L. DITMARS will sail for Trinidad on August 17, where it is reported that he will make a preliminary survey of the Lesser Antilles to determine the most desirable place in which to carry on research during the summer of 1935.

DR. WILLIAM W. DIMOCK, head of the department of animal pathology at the University of Kentucky, on invitation of the British Bloodstock Agency, will visit England and France to give technical advice and lectures.

DR. PERCY E. RAYMOND, professor of paleontology at Harvard University, expects to spend the summer in Esthonia, collecting fossils for the Museum of Comparative Geology.

DR. P. W. WHITING, secretary-treasurer of the Genetics Society of America, writes that a meeting of the Genetics Society of America will be held at the Marine Biological Laboratory, Woods Hole, Mass., on Wednesday and Thursday, August 22 and 23. There will be sessions for reading short papers and for informal discussion as well as demonstrations of research material. The Marine Biological Laboratory is scheduling a program of papers for Tuesday evening, August 21, which will be of interest to geneticists. The detailed program will be posted at the laboratory shortly before the meeting. Information as to rooms in private houses, hotels, etc., may be obtained at the office of the Marine Biological Laboratory or from the secretary.

THE Northeastern Section of the American Society of Agronomy held its annual summer meeting in New Jersey on June 21, 22 and 23. About a hundred representatives of agronomic, extension and commercial firms from Maine, Massachusetts, Connecticut, Rhode Island, New York, Pennsylvania, New Jersey, Delaware, Maryland and the District of Columbia inspected the work in progress at the Agricultural Experiment Station at New Brunswick, and the outlying fields visited. The officers elected for 1935 are: *President*, Dr. H. B. Sprague, New Brunswick, N. J.; *Vice-president*, Dr. J. A. Bizzell, Ithaca, N. Y.; *Secretary-Treasurer*, Dr. R. P. Thomas, College Park, Maryland.

THE following letter has been addressed to the London *Times* by the Lord Rutherford of Nelson, chairman of the Academic Assistance Council: "By your courtesy I was allowed recently to give your readers an account of the first year's work of the Academic

Assistance Council. I am pleased to say that since then the council has received several contributions towards its work for a second year, including a block grant of £2,500 from the Central British Fund for German Jewry and a grant of £500 from the American Joint Distribution Committee. We have received numerous contributions from graduates of our universities, who are thus helping our work in the defence of academic freedom. In some cases school staffs have made special common room collections and sent a joint contribution. We are deeply encouraged by this support and extremely grateful to these contributors. Our needs, however, are still urgent. We have now a sum of £6,721 for our work next year. As some of the academic committees on the continent are unable to continue, the demands on the council in this country are likely to be still heavier, and this sum will not be sufficient for even our immediate needs. May I appeal through your columns for further financial assistance? Contributions, great or small, will be gratefully acknowledged if sent to me at the Academic Assistance Council, Rooms of the Royal Society, Burlington House, Piccadilly, W.1."

THE patenting by members of Harvard University of discoveries or inventions bearing on matters of health and therapeutics is undesirable, the various faculties of the university have voted, and, therefore, the Harvard Corporation has issued the following statement: "In the opinion of the Faculties of Medicine, Public Health, Engineering and Arts and Sciences, the patenting by members of the university of discoveries or inventions bearing on matters of health and therapeutics is undesirable. The president and fellows of Harvard College, therefore, have adopted the rule that no patents primarily concerned with therapeutics or public health may be taken out by any member of the university, except with the consent of the president and fellows, nor will such patents be taken out by the university itself unless they be dedicated to the public. The president and fellows will provide legal advice to anyone who desires steps to be taken to prevent the patenting by others of his discoveries or inventions."

DR. RALPH D. HETZEL, president of the Pennsylvania State College, reports that The Pennsylvania Research Corporation has been formed to prevent private interests from pirating inventions and discoveries made at the college and to insure that they shall be for the public benefit. Since the college is state-supported, the results of research and invention should be available to the public. In the past there has been no provision for reserving the patent rights on such inventions from private encroachment.

ACCORDING to *The London Times*, a second attempt is to be made by German mountaineers to scale Nanga

Parbat (26,629 ft.) in the Kashmir Himalaya. The expedition is being organized by Herr Merkl, leader of the previous attempt in 1932, which had to be abandoned after a height of nearly 23,000 feet had been reached. The 1932 party included two members of the American Mountaineering Club, but the new expedition will consist entirely of Germans and Austrians, eleven in number, and all experienced mountaineers. Two of them, Herren Ashenbrenner and Berehtold, accompanied Herr Merkl in 1932, and two others, Herren Schneider and Wieland, took part in the Dyrenfurth Himalayan expedition in 1930. The expedition will leave Munich for India next month, and intends to take the same route as that followed in 1932.

THE zoological garden of Basle has received a legacy of half a million Swiss francs (£30,000) through the will of a deceased citizen, the late Ulrich Sauter, which will enable the garden to enlarge its rich collections. Basle is known for its magnificent bird-house. In its different wings it contains specimens of nearly all living bird species from the South American condor down to the Brazilian humming bird. African big game is as well represented as Arctic fauna. Last year's inventory showed a total stock of 386 mammals in 96 species, 2,328 birds in 433 species and 300 reptiles in 14 species, altogether 3,014 animals. The yearly expenditure amounts to an average of about 400,000 Swiss francs, which sum is covered by 300,000 francs from entrance fees and 100,000 francs interest on endowments and the sale of animals reared in the establishment.

THE Japanese correspondent of the *Journal of the American Medical Association* reports that the Rockefeller Foundation in 1930 proposed the donation of a large sum of money to establish an institution in Japan to train medical workers and experts. The proposal, however, seemed to be abandoned in 1931 when the foundation announced the discontinuance of new enterprises. But recently it was decided to go ahead, as it was planned at first. At a recent cabinet council, the acceptance of the donation was recognized by the government. The new institution is expected to be completed in two years. According to the announcement by the sanitary bureau of the home office, the new institution will train and teach those who want to be public health workers, while medical graduates will be given postgraduate training. As there has not been such an institution in Japan, social medical problems have not been investigated. Those problems, heretofore untouched, will immediately be taken up. Attached to this institution in the local towns and villages will be the "health house," where those who graduate from the central institution will work for a while. The expense of

maintenance will be contributed for three years by the foundation, and then the local houses will be put under the management of the local government.

THE degree of master of science in engineering has been established at Cornell University and will be granted upon recommendation of the Engineering Division of the Graduate School to those graduate students who have successfully completed a course of study or research majoring in some specialized branch of engineering for which they have the necessary prerequisite training. No student may be admitted to candidacy for this new degree whose training does not include work in one foreign language, equivalent to two units of entrance.

UNDER the auspices of the Academy of Natural Sciences of Philadelphia the two-masted schooner *Morrissey*, commanded by Captain Rob Bartlett, has sailed from New York for a three months' exploring and collecting trip along the west coast of Greenland as far north as Ellesmere Land. The members of this expedition, which is sponsored by R. R. M. Carpenter, of Wilmington, Delaware, a trustee of the academy, are: William K. duPont Carpenter, son of Mr. Carpenter; Harry J. Lance, Jr., of the museum staff, and Robert F. Dove, who will join the ship at St. John's, Newfoundland, and a representative of the Canadian Government. An expert photographer will accompany the expedition to make motion pictures. The ship is stocked with provisions and fuel for a two years' stay in case unusual conditions should be encountered. The chief objectives will be to secure specimens of birds and animals and collect fishes and other sea animals. It also is hoped that some definite information may be obtained as to the nesting and breeding habits of the greater snow goose and the common brant, two birds which summer in Arctic lands and in the autumn migrate southward to North Carolina, and even as far as

Cuba. After skirting the coast of Labrador, the *Morrissey* will proceed through Davis Strait into Baffin Bay and head for Cape York to inspect the Peary memorial monument erected there last summer. Captain Bartlett was commander of the *Roosevelt* when Peary made his successful trip to the Pole in 1909.

THE birth rate in the United States during 1933 was 16.4 per 1,000 population, according to a report of the Census Bureau in the *New York Times*. The infant mortality rate was 58.2 per 1,000 live births. These figures represent a reduction in the birth rate but a slight increase in the infant mortality rate from 1932. However, in 1932 there were no figures for Texas. In 1932 the rates were as follows: Births, 17.4; infant mortality, 57.6, and still births, 3.8. The still birth rate for 1933 was 3.7 per hundred. The birth rate for 1933 is the lowest reported since 1915, when registrations began. New York, Pennsylvania, Texas and Illinois lead the states with the greatest number of births, respectively, as follows: 187,139, 157,046, 107,924 and 105,861. The states with the highest birth rates per 1,000 population are New Mexico, 26.7; North Carolina and Utah, each with 22.9; South Carolina, 22.7; Mississippi, 21.6; Alabama, 21.1, and Virginia, 21.0. The lowest birth rates are for Oregon, 12.2, and California, 12.4. Infant mortality rates, which are based on the number of deaths of infants under one year of age per 1,000 live births, are excessively high in New Mexico (134.2) and Arizona (111.4)—both states with large nomadic Indian and Mexican populations. The next highest rate is 78.4 for South Carolina. The lowest rates reported are those for Washington and Oregon, 38.9 and 39.3, respectively. The birth rate decreased from 1932 to 1933 in every state except Nevada, Oklahoma and Vermont. The infant mortality rate, while showing a slight increase for the entire country, actually decreased in twenty-three states.

DISCUSSION

REFORMS IN CHEMICAL PUBLICATION (DOCUMENTATION)

IN recent years it has become increasingly evident that a reorganization of the production and distribution of chemical publications is needed. The number of journals and other documents is now so heterogeneous that, even though one has access to excellent libraries, it is practically impossible to obtain and consult all original published articles on a given subject. An amelioration of this situation is necessary if chemistry is to continue to advance at a rapid rate.

With this object in view, the Office International de Chimie (O. I. C.) was organized several years ago for the purpose of enlisting the cooperation of representatives of various countries, qualified by experi-

ence and authority, in finding a solution of this problem. Several meetings have been held and attention has been directed in the first place towards establishing the form and methods of international cooperation. As a basis for suggestions along these lines the existing situation in regard to chemical documentation has been studied. The local, specialized and national efforts have been reviewed. The relation of chemical documentation to that of other sciences and human interests has been considered. From this broader point of view the O. I. C. has endeavored to enlist the aid of the International Institute of Intellectual Cooperation of the League of Nations. The suggestion has been made that a comprehensive International Guide to Documentation be prepared.

Among the individual suggestions which have been made for the reorganization of scientific publication and bibliography perhaps the most comprehensive is that communicated privately for criticism to interested persons during the past year by Mr. Watson Davis, of Science Service, and recently presented by him as an address before the Chemical Society of Washington.

Mr. Davis's plan embraces not only chemical but all other scientific publication. He suggests that a central scientific information institute (S. I. I.) might eventually be established and thus perform the double function of publication of current original communications and the furnishing of bibliographies and photographic copies of current and previously published scientific documents.

He proposes that a photographic process of reproduction of documents be substituted for publication by means of the printing press, in all cases except papers of general interest and abstract journals.

According to his plan printed journals of original research would disappear and all original communications would be submitted to the Scientific Information Institute. Abstracts of these would be published in the appropriate abstract journals. The individual would gain his knowledge of new discoveries in science by means of the abstract journals. He would then order from the Scientific Information Institute photographic copies of all original papers desired. He would thus pay for and receive only those publications he needed for the particular research in which he was engaged.

The proposal made by Mr. Davis contemplates a complete reorganization of the present methods of scientific publication. Although this may be advantageous, it certainly can only be achieved very gradually. It is therefore necessary to prescribe the successive steps towards this end which may be taken without too greatly disturbing the existing order of things—such steps as will at first supplement present efforts rather than supplant them and render those services which changing conditions are making increasingly difficult.

It is believed that the inauguration of a service of photographic reproduction of chemical publications would be an initial step which would satisfy the conditions mentioned. This might conveniently be referred to as the American Bureau of Chemical Documentation (A. B. C. D.). Its initial function would be to make and distribute photographic copies of documents describing chemical research.

As will be realized, the success of such a venture depends upon the perfection of a satisfactory and economical process of photographic reproduction of printed documents. Some progress has already been

made in this direction, and it may be assumed that suitable devices to meet the particular needs of the case will be developed.

It is probable that the most satisfactory system will be one in which 16 mm film is used, and from such strips of negatives of printed pages positives will be prepared and these mounted in windows on filing cards. Such cards need not be much larger than 10 × 15 centimeters and have sufficient space for typewriting the author's name, title of paper and its classification number in addition to the window in which will be fastened the film strip containing the photographs of some 20 printed pages. For longer papers two or more cards would be required. For reading these cards a small table projecting machine would be necessary, and this should permit of variable enlargement according to the desires of the reader.

When such standardized equipment becomes available there should be established in each country a Bureau of Chemical Documentation in which photographic copies of current and former publications may be made for those who request them. Naturally, the bureau must have access to excellent libraries and be provided with filing cases for conserving the negatives prepared of all original papers demanded.

In the beginning the service rendered by the bureaus would undoubtedly be most appreciated by chemists working in localities not well provided with chemical libraries. This service would enable such persons to undertake research not otherwise possible. It would in fact put them on an equal footing with chemists having access to the best stocked libraries. The convenience of having so much of the literature of a given subject in one's hands in a convenient form can hardly be overestimated. The fact that the cards do not have to be returned promptly to the library, as is the case with borrowed books, should be particularly appreciated. They are available for consultation indefinitely and if lost or destroyed can be easily replaced.

There is, however, an even greater advantage and economy which such a system of furnishing copies of original papers would provide. This is in reference to the printed publication of original papers.

At present the number of papers offered to chemical journals for publication is far in excess of the number which can be printed with the available resources. Many of these papers are refused and practically all are accepted only if they are condensed to a considerable degree. This results in the printing of many papers which are in large part unintelligible to those for whose benefit they were written. In such cases it would be far better if only a brief résumé of the paper was printed and the original complete communication placed on file in the editorial office or

elsewhere. Photographic copies of it would then be distributed by the B. C. D. exactly as would be done for all other papers. To those requiring full details of the investigation this plan would be of inestimable benefit and to editors of journals it would probably provide a welcome relief from frequent embarrassment.

It may be expected that this curtailment of printed publication would be taken advantage of on an ever-increasing scale and the amount of such unprinted chemical literature eventually would become very great. The cost of distribution in this way would be so much less than by the printed journal that certain of the more theoretical publications could probably be discontinued and many others greatly reduced in size and circulation.

If this plan were put into operation by the American Chemical Society and by similar organizations in other countries the photographic copies of these original unprinted papers would be exchanged by the various Bureaus of Chemical Documentation and thus chemists of all countries would be able to receive copies of them promptly.

Since the pressure of publication in printed journals would be relieved, funds not devoted to that purpose could be diverted to the expansion and improvement of abstract journals. This is especially desirable since it would be principally from these that chemists would gain their knowledge of new work and make out their orders for copies of original papers. The chemical literature needs of a chemist would then be almost completely supplied by his abstract journal and the photographic copies of papers furnished by the B. C. D. Borrowing from and returning journals to libraries would be reduced to such an extent that a considerable saving in service rendered by libraries would result. This is one of perhaps many indirect economies that would result from the wide-spread adoption of a system of photographic reproduction of chemical documents.

If this project should be undertaken by the American Chemical Society it is probable that this service would eventually prove to be the greatest which it renders to our own chemists and those of other nations.

From an international standpoint the Bureaus of Chemical Documentation, established in the various countries, would soon become the centers for the promotion of cooperation in all matters pertaining to chemical publication. Not only would negatives of deposited original unprinted papers be exchanged, but reproductions of occasional and rare documents as well as complete numbers of the current journals. Thus each B. C. D. would rapidly acquire an enormous mass of chemical publications in a compact form and suitable for unlimited reproduction. It would

become the most important center of chemical documents in each country.

Such an exchange of material would undoubtedly lead to many other kinds of cooperation. Such details as reference numbering, classification, cataloging, etc., of papers would eventually be reduced to a uniform practice throughout the world. It is even likely that attention would be given to nomenclature, abbreviations, symbols and many other subjects of international concern to chemists.

With the perfection and international adoption of this system of chemical documentation it is reasonable to expect that other branches of science will quickly follow suit. Bureaus of documentation similar to those for chemistry would be organized for other sciences and the same equipment used for the photographic reproduction and the projection of these for reading. Thus the goal described by Mr. Davis would be gradually approached.

It is probable that, owing to the large scale of its production, the cost of the necessary photographic equipment would not be excessive. The perfection of such mechanism is a subject worthy of the intensive study of the foremost apparatus makers of the world. The success of the undertaking depends upon the solution of this initial but largely mechanical problem. There is little doubt that sufficient ingenuity to perfect every detail of the necessary equipment will be forthcoming.

The question of the cost of the operation of such a system of distributing chemical documents should not be a serious one. It is probable that a relatively small proportion of the funds now expended for printing would be sufficient. The resulting economies and advantages to each worker may be expected to be so great that any reasonable expenditure will be largely repaid in the increased productivity of chemists of all nations.

ATHERTON SEIDELL

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THE CONTROVERSY CONCERNING THE PHYSIOLOGICAL EFFECT OF TRI- HYDROL IN LIQUID WATER

PORTIONS of an article by T. C. Barnes in *SCIENCE*¹ for May 18, 1934, under the above title might prove somewhat misleading to any one who did not refer to the original literature there cited. It may, therefore, be not inappropriate to set down a few quotations from this article and to add comments.

"Some years ago Baker² suggested that association takes place more slowly for liquids than for gases, *i.e.*, water heated at 80° C. for 48 hours (in presence of a catalyst) may exhibit an altered vapor pressure

¹ T. C. Barnes, *SCIENCE*, 79: 455, 1934.

² Baker, *Jour. Chem. Soc.*, 130: 949, 1927.

which persists for days."³ In view of more recent work,^{4,5} it is very doubtful if any one familiar with the literature would now support Baker in this.

"Menzies expected a greater vapor pressure difference near 0° C. than at 25° C. in spite of the fact that 0° C. is the triple point at which the vapor pressure of ice (almost 100 per cent. trihydrol) and water (37 per cent. trihydrol) are the same (i.e., both 4.579)."⁶ What Menzies said⁷ was: "In the hope of favoring the persistence of polymerized molecules, the bath in another experiment was maintained at 3.5° C." This hope, not justified by the experimental result, of detecting non-equilibrium values is regarded as not unreasonable by T. C. Barnes himself when he writes: "It is possible that the equilibrium concentration of hydrols in ice water is not instantaneous."

"Menzies previously claimed that water vapor contains no polymers, but this was corrected by Maass and Mennie."⁸ These authors state: "It is worth noting that a similar figure is obtained from Menzies' data, if the Clausius-Clapeyron equation be accepted as the more reliable of his methods." As these words indicate, Menzies employed two distinct methods for evaluating the density of water vapor from experimental data taken from the literature. Because the two results were discordant, Menzies drew especial attention to this "notable discrepancy that requires explanation."⁹ The excellent work of Maass and Mennie tends to confirm the higher density value (at 73°), and is in harmony with their suggestion of the presence of polymers (dihydrol) to the extent of about one half of one per cent. at this temperature; while the discrepant values computed by Menzies, if averaged, would point to a proportion of polymers negligibly small. In either case, it is difficult to see the relevance of slight association of water in the vapor phase to the present discussion.

There is no *a priori* reason why the positive results by the biological method reported by Barnes may not be correct, for the biological method can be incomparably more sensitive than many of the physical methods. Those of us who have used physical methods with negative results are obliged to report them as they are, although positive results would doubtless have had greater interest because of their very abnormality.

ALAN W. C. MENZIES

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³ T. C. Barnes, *loc. cit.*

⁴ West and Menzies, *Jour. Phys. Chem.*, 33: 1893, 1929.

⁵ Wright and Menzies, *Jour. Am. Chem. Soc.*, 52: 4699, 1930.

⁶ T. C. Barnes, *loc. cit.*

⁷ Menzies, *Jour. Am. Chem. Soc.*, 43: 851, 1921.

⁸ Maass and Mennie, *Proc. Roy. Soc.*, 110A: 198, 1926.

⁹ Menzies, *loc. cit.*

LINES OF NEUTRAL SULFUR IN PROCYON

IN connection with the recent paper on S I in the spectrum of the sun by Miss Moore and Babcock¹ the following results obtained from measurements of stellar spectra may be of interest. Three lines measured in Procyon at $\lambda\lambda$ 6743.52, 6748.69 and 6757.25 can be satisfactorily identified with laboratory lines of neutral sulfur. The first is barely visible, but the other two are quite definite.

Through the kindness of Dr. Morgan, I have been able to examine a three-prism spectrogram of the same star in the ordinary photographic region. Three stellar lines agree with the laboratory lines of sulfur at $\lambda\lambda$ 4694.13, 4695.45 and 4696.25. These three lines were also measured by Dunham² in α Persei but were not identified by him.

The three red lines observed in Procyon are definitely absent in Arcturus, Aldebaran and Betelgeuze, nor can they be seen with certainty on my plates of the sun. However, Miss Moore and Babcock have shown that they are actually faintly present in the sun. This behavior of the lines is entirely consistent with their excitation potential of 7.8 volts.

F. E. ROACH

YERKES OBSERVATORY

ADDITIONAL TRIASSIC DINOSAUR TRACKS FROM PENNSYLVANIA

LAST year W. O. Hickok and the writer reported an occurrence of dinosaur foot tracks in the Triassic red beds near Yocumtown, Pennsylvania.¹ Two species, each belonging to a different genus, were identified. These are *Anchisauripus sillimani* (E. Hitchcock) and *Grallator tenuis* E. Hitchcock. Two additional discoveries have subsequently been made. These are significant because, first, they are new localities for a kind of fossil comparatively rare in Pennsylvania; and, second, they extend the known geologic range of Triassic dinosaurs in the state.

The Triassic of south-central Pennsylvania consists of two formations with subdivisions, thus:

Newark Group (Upper Triassic)

Gettysburg formation	16,000 feet
Arendtville fanglomerate	
Heidlersburg member	
Lower shales	
New Oxford formation	7,000 "

These beds are more or less closely equivalent to the type Newark series of New Jersey. The Yocumtown tracks came from a zone near the middle of the Gettysburg formation in beds of alternating red shale and sandstone. More precisely they may be thought

¹ *Astrophysical Journal*, 79: 492, 1934.

² Contributions from the Princeton University Observatory, No. 9, 1929.

¹ W. O. Hickok and Bradford Willard, "Dinosaur Foot Tracks near Yocumtown, York County, Pennsylvania." *Proceedings, Penna. Acad. Sci.*, Vol. vii, pp. 55-58, 1933.

of as belonging to the upper part of the lower shales of the Gettysburg.

Last summer Mr. P. L. Killeen collected and turned over to the writer a track from gray shale outcropping about one mile north-northwest of Table Rock, which is six miles north of Gettysburg. This example is thought to belong near the middle of the Heidlersburg member of the Gettysburg formation. The specimen (a single track) is rather poorly preserved, but from its size, proportions and digital pattern it is assigned to the genus *Anchisauripus*. It is smaller than *A. sillimani* (E. Hitchcock) found at Yocumtown, but a specific determination can not be made with any degree of certainty.

Early in April of the present year the Pennsylvania Department of Highways exploded five tons of dynamite while widening U. S. Highway 111 about two miles south of New Cumberland, Cumberland County, where the road rises southward from the lowlands adjacent to Yellow Breeches Creek and enters the more rugged topography of the Triassic belt. This blast shot down large amounts of rock from the uppermost Triassic beds across a section between 300 and 400 feet thick. The succession is a highly varied lithologic series. Considerable amounts of red shale and sandstone are present, but there is also a large proportion of very hard, gray to greenish sandstone. Thick strata of coarse conglomerate (fanglomerate) are interbedded with the finer elastics. Ripple marks, mud cracks and raindrop imprints are common in the shales, and rippled sandstone surfaces are not rare. Such a series implies shifting distributary streams, spreading fans, rapidly changing local conditions. The region probably supported little life, and preservation of any records of such would be quite fortuitous.

Occasional impressions of fragments of plant stems are distributed throughout all the sediments, but chiefly in the red beds. In a thin slab of dark red, finely arenaceous shale, broken out from near the middle of the section a single dinosaur track was discovered by the writer. Its rarity is evident, for it is the only one found in the section. The slab carries mud cracks, rain prints and possible plant stem impressions. The track is of the same genus as that from the Gettysburg region, but its better preservation assigns it with reasonable certainty to *Anchisauripus sillimani* (E. Hitchcock), which is the larger of the two species of tracks found at the Yocumtown locality.

From these observations it is seen that the genus *Anchisauripus* lived in Pennsylvania through middle and late Newark time. The Yocumtown tracks are probably the oldest; the Table Rock specimen nearly as old; and the foot track from the road cut south

of New Cumberland the youngest. Scarcity of tracks and poor preservation make additional data most desirable.

BRADFORD WILLARD

PENNSYLVANIA TOPOGRAPHIC AND
GEOLOGIC SURVEY

A SOURCE OF BOTANICAL MISINFORMATION

THERE has recently been published, under the title "Pioneering with Wild Flowers," a book purporting to furnish information as to native plants and their cultivation. Written in an interesting style and well illustrated, it will probably be widely circulated, and many people are likely to consider the data in it authoritative. It contains, however, a number of mistakes which should be brought to the attention of scientists generally, so that they can warn their friends who may have purchased the book.

Some of the errors are merely ludicrous, as for instance where a well-known native plant is designated *Aster "linnaeafolia"*—the Linnaeus-leaved aster. Again, *Trillium luteum* is renamed *T. "flavum"* for the naïve reason that it "does not seem to be classified by our botanists." Misspelling, misidentification of species and mislabelling of cuts are frequent.

However, the primary purpose of this note is to call attention to certain potentially dangerous statements. Several plants which only experts can cultivate successfully, such as the orchid *Arethusa* and the birdsfoot violet, are repeatedly stated or implied to be easy to grow. This will of course aid in the sale of these plants by dealers, but will also result in an increased destruction of these rapidly vanishing species, and must be opposed by every conservationist. On the other hand, certain undesirable plants are recommended; thus, one of the most virulently weedy species of *Hieracium* known is misidentified as *Senecio aureus* and praised as a garden plant. All that need be said is that any one who plants it in their wildflower garden will regret doing so ever after.

Finally, there is even danger to human life in an error made on page 77, where *Veratrum viride* is confused with *Phytolacca decandra*, with the remark that "the roots are supposed to be poisonous, but I understand that the young shoots are eaten as greens." Actually, there are on record a number of cases of fatal poisoning of people by shoots of *Veratrum*, mistaken for edible greens, and it is included among the 30 most poisonous plants of the United States by Chesnut (U. S. D. A. Farmers' Bulletin 86.) The public should certainly be advised to beware of such books written by pioneers instead of by experts.

EDGAR T. WHERRY

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

THE USE OF AN ABSORBENT PULPIT IN THE CULTIVATION OF AEROBIC ORGANISMS

THE method described has been applied especially to fungi in an attempt to study their aerobic tendencies. The fungi chosen were members of a group which had proven pathogenic to man.

The principle of absorption was utilized as a basis in the development of this method. A good absorbent possessing neither nutrient, antiseptic, chemically or physically reactive properties is suitable. Blotting paper was chosen. A fast color is desirable, the most suitable color being dependent on the color of the organismal growth to be studied. For adaptation to test-tubes a two-legged pulpit of blotting paper with the horizontal portion above the fluid media proved satisfactory. The organism was planted on this portion and its growth observed. Some organisms grew on this portion alone, some on it and in the media and some in the media alone. Where growth occurred in both situations it often varied in marked degree both in character and extent.

The pulpit principle can also be utilized for growth in the petri dish. In this instance sufficient legs must project into the liquid media to keep the flat portion moist. Absorbent cotton placed under the flat portion may aid in this respect. It may be found necessary to support the moist absorbent by glass rods, etc. There must be sufficient fluid media present in the bottom of the petri dish to maintain the moisture of the pulpit at all times. The pulpit may be poured as a plate with liquid media or melted solid media. The advantage in the instance of melted solid media is that a very thin layer can be applied to a pulpit colored so that the greatest of contrast can be obtained and liquid media can be added to the petri dish in sufficient amount so that through the absorbent the solid media will be kept moist.

Tests of the principle in the test-tube and petri dish gave greater promise of application in the former. Bacteria tried (*B. subtilis*, *Staphylococcus aureus*, *B. coli*) showed scant growth on the pulpit and prolific growth in the media, while fungi (*trichophyton interdigitale*, *epidermophyton inguinale*) grew well on the seat.

There are numerous advantages of the pulpit. Growths which because of their aerobic tendencies would be inhibited or destroyed by sinking in a liquid media can be prevented from doing so. The type of growth on the pulpit, its legs and in the media can be observed. The site of growth can be observed. Growths have been carried on the pulpits for over

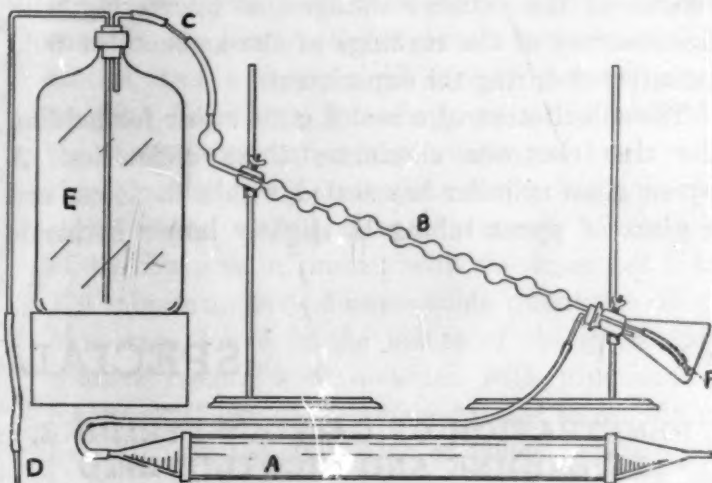
two months and have shown no tendency to dry out. In a control on Sabourand's proof media there has been drying. It is necessary to test the absorbent used and assure oneself that it is innocuous.

JOHN W. WILLIAMS

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AN APPARATUS FOR THE MEASUREMENT OF RESPIRATORY RATE

THE apparatus shown in the figure was found very useful in measuring changes in the respiratory rate of raspberry canes held at different temperatures. The carbon dioxide evolved by the canes was absorbed with tenth normal barium hydroxide. Unneutralized barium hydroxide was titrated with tenth normal hydrochloric acid. The respiration chamber (A) is of galvanized iron and has removable ends, which were sealed with paraffine. Any type of respiration chamber may be used.



The absorption tube (B) was blown from 8 mm glass tubing. A tube of this size holds 25 ml of liquid. The glass tube (F) has a 4 mm bore. The capillary tube (C) causes air to flow through the absorption tube at an even rate. The bore of this tube, which is small, also determines the rate of air flow. The rate at which water is siphoned from the aspirator bottle (E) is controlled by the capillary tube (D). If the aspirator bottle is filled before making a determination, the same quantity of air is always drawn through the apparatus in a given time.

The apparatus was used successfully at freezing temperatures by filling the aspirator bottle with a denatured alcohol solution, and adding 95 per cent ethyl alcohol to the barium hydroxide in the absorption tube.

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A MODIFICATION OF THE MUDD ELECTRO-ENOSMOSIS APPARATUS¹

In further experiments on electroenosmosis across intact dog tooth enamel membranes,² the writer has found the following modification of the Mudd electroenosmosis apparatus of assistance in eliminating the tendency of the rubber stoppers to loosen in the electrode chamber.

The changes in the apparatus concern the zinc electrode cell, Z (Fig. 1). The cell described by Mudd³ makes use of a cylinder of glass, open at both ends. In the upper end is placed a perforated rubber stopper through which passes a glass tube which connects the electroenosmosis apparatus proper with the zinc electrode chamber. In the lower end of the glass cylinder is placed a second perforated rubber stopper, through which the zinc electrode passes into the glass electric chamber.

When the chamber is filled with zinc sulfate and then tightly closed top and bottom, the rubber stopper at the lower end carrying the zinc electrode tends to loosen and move out of the chamber. As a result the volume of the chamber changes, so interfering with the accuracy of the readings of the amounts of fluid transferred during the experiment.

The substitution of a sealed glass collar for holding the zinc electrode eliminates these difficulties. A pyrex glass cylinder has sealed within its lower end a piece of pyrex tubing B, slightly larger in inside

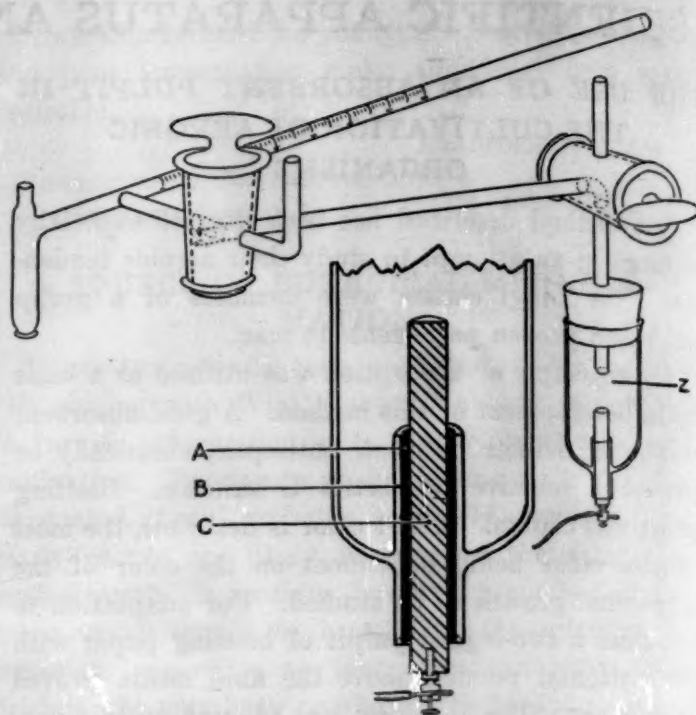


Fig. 1.

diameter than the diameter of the zinc electrode C. The lower end of the glass cylinder containing the glass collar is warmed slightly, and the zinc electrode is placed in the chamber through the glass tubing. DeKhotinsky cement A is then sealed in the space between the zinc electrode and the inside of the glass collar.

HENRY KLEIN

SPECIAL ARTICLES

PENETRATION OF GASEOUS PYRIDINE, PIPERIDINE AND NICOTINE INTO THE BODIES OF CERTAIN INSECTS¹

THE cuticula of insects presents an effective barrier to most injurious substances which are found in the environments of these animals. Its physical structure and chemical composition afford great resistance to all but the most active chemical agents, and the view has long been held that gases and substances in solution do not penetrate the cuticula directly, but rather enter the body through the spiracles and pass from the tracheal system to the tissues.

Recently, however, it has been shown that the cuticula of some insects, at least, is not only permeable to respiratory gases but to certain toxic substances as well. For instance, Thorp² has found that elimi-

nation of carbon dioxide takes place largely through the cuticula of many small, thin-skinned insects, the tracheal system being in such forms of minor respiratory importance. In some adult Coleoptera, carbon dioxide seems to pass through the cuticula, although the permeable areas may be limited, and among pupal forms, the evolution from the cuticula may be slow or rapid. Hartzell and Wilcoxon³ have shown that pyrethrins penetrate directly the cuticula of insects when they are applied to the body surface at points remote from the spiracles. Ethyl thiocyanate, methyl isothiocyanate and nicotine also were found to penetrate the cuticula in quantities large enough to provoke toxic reactions. Portier⁴ immersed the tips of the antennae of butterflies in solutions of nicotine and

¹ From the Laboratory of Pathology, Yale University School of Medicine.

² H. Klein, *Journal of Dental Research*, 12: 87, 1932.

³ S. Mudd, *Journal of General Physiology*, 9: 369, 1926.

¹ Rockefeller Fluid Research Fund Project No. 9, Iowa State College.

² W. H. Thorp, *SCIENCE*, 68: 1766, 433-434, 1928.

³ A. Hartzell and F. Wilcoxon, *Contrib. Boyce Thompson Inst.*, 4: 1, 107-117, 1932.

⁴ P. Portier, *Compt. rend. soc. biol. (Paris)* 105: 367-369, 1930.

observed toxic manifestations which indicated the penetration of nicotine through the cuticula. Hockenyos⁵ has recently stated that sodium fluoride is absorbed directly through the cuticula of two species of cockroaches, especially through the thinner articular and intersegmental areas.

The works mentioned above treat of penetration from solids, liquids or solutions. The results of the investigation reported below are concerned with the penetration of gaseous pyridine, piperidine and nicotine into the cuticula of adult American cockroaches, *Periplaneta americana* (L.), larvae of the corn ear worm, *Heliothis obsoleta* Fab. and adult red-legged grasshoppers, *Melanoplus femur-rubrum* (DeGeer). This paper contains a preliminary statement of a part of the results obtained to date. More detailed publications will appear later.

The insects were exposed to approximately maximum vapor concentrations of the compounds in air at 30° C., the exposure times being varied as desired. After exposure, the insects were washed free of any surface-adhering compound, and were then refluxed with absolute alcohol acidified with tartaric acid. The extracted material was freed of alcohol, made alkaline with NaOH and subjected to steam distillation to recover the toxic compound. The distillate was caught in a weak tartaric acid solution and concentrated to the desired volume.

The compounds were quantitatively estimated in the distillates by successive dilution of aliquots until a limiting precipitate was obtained with phosphomolybdic acid reagent, equivalent to that given by a known solution of the compound in distilled water. The procedure was a modification of that used by Fulton⁶ for the detection of alkaloids. With a knowledge of the weight of the original insect tissue extracted, the volume of the distillate, degree of dilution and concentration of the toxic compound at the limiting dilution, it was possible to express in terms of a unit weight of tissue the approximate amount of toxic compound absorbed. To confirm detection of the compound with phosphomolybdic acid reagent, the distillate was tested at the limiting dilution, or at greater dilution, with another suitable alkaloid reagent. In this manner, detection of the compound, if present, was assured, and the quantitative results were sufficiently accurate for approximate comparative purposes.

When entire insects were subjected to the vapors of the compounds, generally more pyridine, piperidine or nicotine, in mg per gram of tissue, was found

in the cuticula than in the entire insects. The comparisons were made when approximately 50 per cent. of the insects had succumbed to the vapors. The results of the experiments show that relatively large quantities of the vapors of these compounds penetrate the cuticula of the insects.

To prove that these toxic gases do not necessarily first enter the body through the spiracles, pass from the tracheae to the blood and then enter the cuticula from the blood, special tests were made with corn ear worm larvae, adult cockroaches and adult red-legged grasshoppers. The posterior 3 or 4 pairs of abdominal spiracles of a corn ear worm larva were coated with beeswax, and the larva was sealed in the cork stopper of the bottle in such fashion that only the portion of the abdomen with covered spiracles was in contact with the toxic vapors. Control larvae, similarly fastened, lived for many hours. After 120 minutes' exposure to pyridine, an abundance of the compound was found in the bodies of the larvae. The same result was obtained with piperidine. Although it is believed the results demonstrate penetration of these compounds through the cuticula, the larvae offered certain experimental difficulties, and a more rigid test of penetration was sought. Individual grasshoppers were fastened on the cork stopper of a large-mouth gas bottle with a single posterior leg projecting through a hole in the stopper, and sealed off with beeswax. Only a part of the leg was in contact with the toxic gas. After 120 minutes, easily demonstrable quantities of pyridine were found in the bodies of the grasshoppers. Similar results were obtained with piperidine and nicotine. Cockroaches were subjected to equally rigid tests. An active circulation of blood, suggesting that in the web of the frog's foot, occurs normally in the anterior wings of the American cockroach. Cockroaches were fastened to the cork stoppers of gas bottles with only a part of one anterior wing sealed off in contact with the toxic gas. After 120 minutes' exposure to pyridine, piperidine or nicotine, the bodies of the treated insects contained sufficient of these compounds to give good quantitative values.

The results of the experiments mentioned leave little doubt that these organic bases in gaseous condition passed directly through the cuticula of the insects. The compounds have been detected, and the amounts quantitatively estimated, in muscular tissue from the wings and legs, in the entire digest tracts, in fat body tissue and in the ventral nerve cords of cockroaches, and in the blood of corn ear worm larvae which have been subjected to the gases.

CHARLES H. RICHARDSON
LOUISE H. GLOVER
LEWIE O. ELLISOR

⁵ G. L. Hockenyos, *Jour. Econ. Ent.*, 26: 6, 1162-1169, 1933.

⁶ C. C. Fulton, *Assn. Official Agric. Chemists*, 13: 4, 491-497, 1930.

MOTOR INHIBITION IN AMBLYSTOMA PRODUCED BY TRITURUS TRANSPLANTS

IN a study of the growth of heteroplastically transplanted salamander eyes,¹ the surprising incidental observation was made that eyes grafted embryonically from the western newt, *Triturus torosus*, to *Amblystoma tigrinum* cause complete paralysis of the hosts, from which they do not recover until two or three days before they begin to feed. In the meantime, development is otherwise normal, neither hosts nor grafts suffering any apparent ill effects. When embryos of these two species are joined as parabiotic twins, recovery of the *tigrinum* twin from the paralysis does not occur until the *Triturus* mate, which develops much more slowly than *Amblystoma*, has completely resorbed its yolk. There is no reciprocal effect of the *Amblystoma* grafts or twins on the motility of *Triturus*.

The substance or substances causing this effect are perhaps associated with the embryonic food reserve of *Triturus*. When ovarian eggs or embryo² are ground with Ringer's, the filtered extract causes paralysis lasting about an hour when injected into the coelom of *A. tigrinum* larvae. Similarly prepared extracts of larvae, following resorption of the yolk, give gradually weaker and finally negative effects, as growth proceeds. The blood of adult females, but not of males, gives positive results, in about one half of the cases tested. It is suggested that the presence of the active substance in female blood can be correlated with periods during which it is being stored in the developing ova.

Oral administration of the extracts in heavy doses has no influence on the *A. tigrinum* larvae, indicating that the material is either converted in the alimentary tract, or is not absorbable by the latter. It can evidently penetrate the skin, although at a very slow rate, judging by a few preliminary tests. Concerning its chemical and physical nature, we know only that it is not present in ether extracts, whereas the residue remains potent; and that it is destroyed by boiling.

It is known that adult *Triturus* skin is rich in toxic secretions, which have been identified, for some amphibians at least, as alkaloidal in nature, and shown to exert a strong depressive action on the heart when injected into other species.³ In order to test the possible relationship of these adult secretions with those responsible for the paralysis described by us, we injected aqueous extracts from minced adult *Triturus* skin into larvae of *A. tigrinum*. The physio-

logical effects are quite different in the two cases. Skin extracts, while depressing heart action strikingly, paralyze the larvae for only brief periods, providing the injection is not so heavy that it causes complete and permanent stoppage of the heart beat; while embryonic extract, or adult female blood, produces prolonged paralysis without affecting the heart beat significantly. On these grounds we are inclined to believe that the substance with which we are concerned is not interpretable as the embryonic forerunner of the adult toxic secretions.

Experiments on this phenomenon of motor inhibition with other forms of the two genera show that it is not confined to *T. torosus* and *A. tigrinum*, although the effect exerted by *Triturus*, and the reaction exhibited by *Amblystoma*, may vary greatly in degree with the species. The strongest effect is produced by *T. torosus*, while *T. pyrogaster* (Japan) and *T. viridescens* produce much weaker results. In the same way, *A. tigrinum* reacts much more positively than the other species of *Amblystoma*, followed by *A. mexicanum* (axolotl), *A. punctatum* and *A. californiense*, in about the order given. For example, eye-vesicles of *T. pyrogaster* grafted to *A. tigrinum* do not paralyze the host embryo, the effect with this combination first becoming apparent when embryos of the two species are joined in parabiosis. Even then, the *A. tigrinum* twin does not remain immotile as long as when it is joined with *T. torosus*. *T. viridescens* gave much the weakest effect, paralyzing the *tigrinum* twin for only about 24 hours. *T. torosus* and *T. pyrogaster*, while both paralyzing *Amblystoma*, do not affect the motility of one another when joined in parabiosis.

An interesting effect of temperature was noted in embryos of *A. californiense* bearing grafted *T. torosus* eyes. When kept in a cool room (12 to 14 degrees C.) the hosts were motile, and it was at first assumed that this species of *Amblystoma* does not react as do the others. On bringing them into a room at ordinary temperature, however, they became insensitive almost immediately. This behavior can be repeated a number of times by alternately lowering and raising the temperature. It is suggested that an increase in temperature might have this effect either by increasing the amount of the paralyzing substance liberated by the cells of the graft, by increasing its rate of distribution (through effect on pulse rate) or by lowering the threshold of sensitivity of the host's nervous system to the agent.

The paralysis produced by transplanted eyes is evidently not due to the immediate connection of the grafts with the central nervous system. *A. punctatum* hosts remain insensitive for the same period of days, irrespective of whether the *Triturus* vesicles are grafted in the normal position or in the region of the

¹ Twitty and Elliott, in press, *Jour. Exper. Zool.*, Vol. 68.

² Embryos younger than "tail-bud" stage have not yet been tested.

³ See Noble, "Biology of the Amphibia."

limb bud. Results kindly communicated by Professor Ross G. Harrison show that other embryonic tissues of *Triturus* in addition to the eye, namely, limb ectoderm or limb mesoderm, cause paralysis when grafted to *Amblystoma*. The responsible agent is probably distributed throughout the embryo, although perhaps in unequal concentrations.

We are not yet prepared to generalize concerning the extent to which other amphibians, and possibly more distantly related animals as well, may react to *Triturus* tissue in the manner described for *Amblystoma*.

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ENZYMES, VITAMINS AND THE ZONE OF MAXIMUM COLLOIDALITY

ARE enzymes definite chemical substances or do they consist of chemically definite active or prosthetic groups attached to a colloidal carrier? The following considerations will reconcile the apparent antithesis which this question assumes to exist.

As with other particulate or dispersed catalysts, the action of enzymes depends primarily upon the exposure to the milieu of large interfacial areas having specific electronic fields of force. But there are other factors. Too great a degree of aggregation of an otherwise suitable enzyme would mean that insufficient areas would be exposed to produce marked activity. On the other hand, too great a degree of dispersion of the enzyme might lead to a particulate kinetic activity so intense that the number of *successful* encounters¹ between enzyme and reactants would be reduced to the level of inefficiency. High efficiency for the enzyme demands, *inter alia*, an intermediate degree of dispersion, which involves a high exposure of active interfacial surface, coupled with a great, but not disruptively great, kinetic activity. These criteria seem to be met in the lower range of the ultramicroscopic field, which approximates the *zone of maximum colloidity*.²

It, therefore, makes no practical difference whether an enzyme consists of a large molecule or a small group of molecules or of a chemically definite active or prosthetic group fixed to a colloidal carrier; for any of these structures might yield particulate units having the essential basis of enzymic efficiency: (1) large exposure of specific active areas; (2) great, but not disruptively great, kinetic activity.

These views are confirmed by certain experimental data. Thus,³ a dilute aqueous dispersion of egg white, heated until it becomes opalescent, showed in

the ultramicroscope a field crowded with very actively moving ultramierons. On addition of some essence of pepsin (15 per cent. alcohol), there was an immediate aggregation of the ultramierons into coagulated, immobile masses. When dilute hydrochloric acid was allowed to diffuse in, the clumps instantly broke up, the ultramierons resumed their active kinetic motion, and then quickly melted away like snowflakes in cold water, the whole field becoming brighter as dispersion into individually indistinguishable smaller particles proceeded.

Some of the same brand of essence of pepsin, when made more acid, showed a marked increase in Faraday-Tyndall effect, and on standing deposited a fine floe. Ultramicroscopic examination also indicated that acidification increased the number and apparent size of particles in the ultramicroscopic field. These experiments were just now made, and an attempt will be made to see what correlation, if any, exists between the acidity, degree of apparent dispersion and activity of pepsin. Changes in the milieu will, of course, affect the substrate as well as the enzyme, so that in considering the final result many factors must be allowed for.

In the case of diastase attacking ungelatinized starch granules, actively moving ultramierons in the enzyme dispersion were seen to gather at and oscillate about the surface of the starch grains, which soon showed indented or "gnawed" margins.

Recent work of Professors Richard Kuhn, Otto Warburg and their collaborators⁴ indicates that the newly isolated water-soluble lyochromes, the flavines,⁵ which apparently constitute vitamin B₂, exhibit enzymic activity when brought into the colloidal state, presumably by fixation on a colloidal carrier. Kuhn states:⁴

According to recent investigations of O. Warburg and W. Christian,⁶ a yellow oxidation-enzyme occurs in yeast. This enzyme, together with a second colorless enzyme and a co-enzyme, is capable of oxidizing hexose-monophosphoric acid. By irradiation in alkaline solution O. Warburg and W. Christian⁷ have obtained crystals of a chloroform-soluble pigment. This has the composition C₁₁H₁₂N₄O₂. It is remarkable that we have obtained apparently the same pigment by irradiation of ovoidflavine. The chloroform-soluble pigment has no more vitamin activity.

Our observations suggest for the first time a reversible relationship between a vitamin and an enzyme. One may imagine that vitamin-B₂ is the exogenous precursor of the

⁴ *Chemistry and Industry*, 52: 985, 1933.

⁵ About 17,000 eggs (50 kilos. dried egg albumin) yielded 50 mg ovoidflavine; 3,000 liters of cows' milk gave 60 mg lactoflavine.

⁶ *Naturwissenschaften*, 20: 688, 1932.

⁷ *Naturwissenschaften*, 20: 980, 1932; *Biochem. Zeits.*, 254: 438, 1932; 257: 492, 1933.

¹ J. Alexander, *SCIENCE*, 65: 62, 1927.

² J. Alexander, *Jour. Am. Chem. Soc.*, 43: 434, 1921.

³ J. Alexander, *Jour. Am. Chem. Soc.*, 32: 680, 1910.

yellow oxidation-enzyme. The formation of the enzyme is supposed to occur by combination of the flavine with a colloidal-carrier. In this connection it is very remarkable that we have observed an excellent increase in growth of animals deficient in vitamin-B₂, which have been given well dialyzed preparations of the yellow enzyme.⁸ Therefore there exist not only free vitamin-B₂, which dialyzes easily, but also vitamin-B₂ attached to carriers of high molecular weight, which can not be dialyzed—just as in the case of the flavines. The relationship, which has been established, can be seen from the following table:

	Soluble in			Activity as	
	Dialysis	Water	Chloroform	Vitamin	Enzyme
1. Flavo-proteins					
Flavo-polysaccharides ...	-	+	-	+	+
2. Flavines	+	+	-	+	-
3. Irradiated flavines	+	+	+	-	-

Following a discussion of flavines as biological hydrogen acceptors, Kuhn concludes:

... the flavines are not only of importance as prosthetic groups and precursors of the yellow enzyme, but they can themselves act as hydrogen acceptors, in other words, as intermediate substances in cell respiration. ... One may be justified in calling the flavines the "methylene blue" of living cells.

Enzymic activity might also appear or become accentuated by the mere aggregation of specific molecules into groups sufficiently large to establish a favorable reduction in the kinetic activity of over-active units. Nor can we overlook the fact that electronic surface areas may arise from such aggregation and also that changes in the milieu (pH, salts, etc.) may exert an effect. Thus The Svedberg⁹ has demonstrated the effect of changing pH in forming and in breaking up groups of ultramicroscopic protein units, and Richard Willstätter¹⁰ has shown how adsorption and desorption (*elution*) of enzymes depends upon the milieu, as well as on the physicochemical nature of the adsorbent. The inquiry naturally suggests itself as to whether co-enzymes may not function, in some cases at least, by dispersing or else aggregating the enzyme particles (which may be molecules) to the colloidal state favorable to activity. Co-enzymes may

⁸ R. Kuhn, *Nachr. Kaiser Wilhelm-Ges.*, 2: 13, 1933; *Beilage, Naturwiss.*, 21.

⁹ The Svedberg, *Jour. Am. Chem. Soc.*, 1924 et seq.; *SCIENCE*, 79: 327-332, 1934.

¹⁰ R. Willstätter, Alexander's "Colloid Chemistry," Vol. II, pp. 361-66, 1928.

also represent particles (they may be molecules), which, on adsorption, complete an otherwise imperfect prosthetic group. Similarly, anti-enzymes may produce an unfavorable degree of dispersion or may mask or "poison" satisfactory prosthetic areas.

The immense effectiveness of minute quantities of vitamins, of hormones, of antigens and of certain potent substances such as histamine and acetylcholine becomes comprehensible when we realize that one single molecule of a specific substance might, under suitable conditions, form, activate or modify a cellular catalyst, and thus suddenly alter the whole internal economy of a cell.¹¹ The action of specific drugs (including narcotics), and the ultimate nature of pathological intracellular changes (including such as may be associated with insanity and drug addiction), must, in many cases, be considered in the light of possible interference with or alteration of the normal catalytic syndrome of a few or of many cells, wherein *chemical specificity* and *optimum dispersity* are mutually cooperative factors. At the lower range of the colloidal zone, we have a reconciliation between the "chemical" and "colloid" aspects of living matter.

The importance of the time factor in biological reactions is obvious. The influence of the zone of maximum colloidalness in controlling the velocity of chemical reactions has been stated thus:¹²

A most striking example of optimum dispersion is found in living matter. Figuratively speaking, if all the chemical substances comprising our organism were in true or crystalloid dispersion, reactions would proceed so rapidly that we would, so to say, live ten years in ten minutes. On the other hand, if coarse dispersion prevailed, it would take ten years to live ten minutes. Every organism is dependent upon the coordination of its chemical reactions *in point of time*, and this leisurely procedure depends largely on *degree of dispersion*, which keeps chemical reaction velocities within certain speed limits through its regulation of free surface and kinetic activity. Life lies between lysis and coagulation. The colloidal zone is, as it were, a vital metronome tolling off the tempo of life.

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¹¹ J. Alexander, *Protoplasma*, 14: 296-306, 1931; *Scientia*, October, 1933; *Arch. di Sci. Biol.*, 19: 409-413, 1934.

¹² J. Alexander, Alexander's "Colloid Chemistry," Vol. II, p. 27, 1928.

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